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## ELECTRICAL WORLD AND ENGINEER

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NEW YORK, SATURDAY, OCTOBER 19, 1901.

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### PAN-AMERICAN AWARDS

We are glad to be able to give with this issue, in a Special Supplement, a very full list of the awards at the Pan-American Exhibition that concern our readers. As noted elsewhere, some of the largest exhibitors did not enter for awards, hence their names will be missed. It cannot be passed over without mention also that the superb work done by Mr. Luther Stieringer, consulting electrical engineer, and by Mr. Henry Rustin, who carried out with admirable success all the illumination plans, passes, so far, apparently without any official recognition. The wonderfully beautiful lighting of the Exposition was not only its chief artistic feature, but its most brilliant exemplification of progress in the mechanical arts. It would appear, however, that some commemorative diplomas and recompenses to collaborators are to follow. Our readers may be interested to observe that a gold medal has been awarded to the publishers of ELECTRICAL WORLD AND ENGINEER.

### CONVENTION ECHOES.

We presented last week in a special supplement a report of the proceedings of the American Street Railway Association, up to the time of going to press with that issue, and in our current number will be found further notes on the discussions, exhibits and exercises. From this, and in many cases from their own participation, our readers will have formed an idea as to the convention, and will certainly agree with us in characterizing it as the best that the association has ever had. The local hospitality was, if we may venture as New Yorkers to speak of it, of the most hearty and liberal character, and such features as the automobile ride in which about 120 electric vehicles took part—all that could be spared from specific duty—were of a more than transient interest. The papers and discussions alike were excellent, while the display of apparatus in Madison Square Garden had to be seen to be appreciated. It was as elaborate and complete as any show got together for a month; and in many respects vied with the Pan-American, or even Paris last year, as an exposition of what is latest and best in the traction art. Moreover, the electrified street railway systems of the metropolis are in themselves an exhibition of the highest order, while the new work going on in the transformation of the Manhattan Elevated and the construction of the Rapid Transit Underground system led the thoughts of the members onward to the great work and larger opportunities lying in the future. Altogether the occasion was one that the Association will find it hard to equal for attendance, quality and for agreeable blending of recreation and instruction. Next year, however, in going to Detroit, another distinct sphere of work will be brought to notice in the interurban, cross-country trolley work, on a gigantic scale, now being carried out by the Everett-Moore syndicate. The American Street Railway Association will celebrate there its coming of age by a significant revelation of its power to include the work of its members that begins on a single street and ends by embracing a State.

### AN AMERICAN PACIFIC CABLE.

Note is made elsewhere in this issue of the efforts of the new American company to lay a Pacific cable, backed by Mackay and Commercial Cable interests. The last speech of President McKinley, advocating an American Pacific cable, is now being sold on the streets and makes its appearance as the dying injunction of the great national leader just as the progressive elements we have named

thus declare their readiness to carry out his ideas and plans. The coincidence is striking, may be intentional, but is none the less of good augury. One feature in the matter demands attention at this point. Mr. Mackay has stated distinctly that the new company asks for neither subsidy, bonus nor guarantee. That would imply that steps have already been taken to make the cable in Europe, where large plants stand waiting eager for such a contract. On the other hand, we believe no wrong is done to Mr. McKinley in stating that his desire and intention were to have the cable made in this country and laid by American ships and skill. To that end, a subsidy would doubtless have been offered, and may still be offered by Congress, this year. We can hardly think it possible for a cable across the Pacific to be self-supporting for some time to come; in fact, the English cable will have the benefit of handsome subsidies and guarantees from the colonies, if not from the home government, as we understand it. Be that as it may, Mr. Mackay has our best wishes, and we can only hope that it will be a brace of American cables that he will put down across the profound depths of the Pacific, connecting this country with its new possessions and new markets in Old Asia.

## Some Problems in Hydraulics.

Governing a hydraulic plant with precision comes rather near being one of the fine arts, and the little note elsewhere in this issue on what happened in the Levis transmission plant points the moral admirably. In this instance the main switch was pulled when the generators were fully loaded, to test the efficacy of the governor in taking care of sudden changes. The governor attended strictly to business, promptly and completely, and shut the gate with a snap so sudden that the pressure took off the bonnet of a 30-inch valve. Good luck and presence of mind averted very serious results, but the lesson is none the less plain. For successful work in hydraulic governing three factors must be reckoned with, each independent of the others. First and foremost, the governing mechanism must be sufficiently sensitive and powerful to work the gates promptly enough to permit accurate control of the speed. It has taken a good many years to evolve a governor able to meet properly this fundamental condition, and just as in steam engine governing, the introduction of electrical machinery had much to do with the progress of invention. Waterwheels had been in use for many years, but generally in work not requiring very steady speed or, on the other hand, in work at so steady load that there was little tendency for the speed to wander; in fact, until the advent of electrical machinery there was very little work of any kind in which a variation of two or three per cent in speed under changing load was a matter of any importance. Given, however, the necessity for improvement, the improvements came until now there are several reliable relay governors with power enough to move any ordinary gates and sensitive enough withal to take account of minute changes in the speed.

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But even this combination of good qualities is not enough to ensure a satisfactory result. Not only must the governor be amply able to move the gates quickly at the least change of speed, but the whole organization of the plant must be such as to enable the prompt opening and closing of the gates to produce steady speed in the machinery. It is of little use to throw the wheel gate wide open if the movement of water in the penstock is so sluggish that the speed can fall seriously before the water gets fairly to work. The hydraulic works must therefore be so planned that governing will be physically possible, granting that the governor does its work properly. We are sorry to say that many plants fail in this particular. We have in this country many skilled hydraulic engineers in the ordinary sense, thoroughly familiar with the technique of developing water powers and installing water plants, but comparatively few of them have a practical acquaintance at first hand with the requirements of an electrical transmission plant. They do not realize that electrical plants present problems that must be treated even in building the dam. Too often the electrical engineer comes upon the scene to find the water power developed and the contract for the wheels already placed. Then he must make the best of a bad matter and take the blame if anything goes wrong. For good governing the one most essential thing is for the water column to respond promptly to the varying aperture of the gates. The shorter the penstock and the sharper its downward pitch, the shorter is the time-constant of inertia in the water column, and the better, on the whole, will be the regulation of the plant. Obviously long and contracted draft tubes and tail-races may seriously interfere with regulation even when the work above the wheel is correctly planned.

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The third requirement is that the changes in the velocity of the water column shall not result in dangerous variations of pressure—dangerous either to the pipes or to the governing mechanism. This requirement is sometimes very difficult to meet, as the case in hand would indicate. It is particularly hard to meet without serious waste of water. In the Western plants using impulse wheels under high heads where the wheels are perhaps at the bottom of a sharply inclined pipe half a mile long, governing would be almost impossible save by the use of the deflecting nozzle which allows the stream to maintain nearly constant velocity whatever the work. At rather low heads a stand pipe open at the top meets the difficulty and damps the variations in pressure. This does not waste water like the constant flow method, but becomes very unwieldly above moderate heads. Out of range of the stand pipe the trouble begins. In some instances the governor is arranged to maintain nearly constant flow by opening a relief valve as it closes the gates. But this again wastes water, and as hydraulic development grows there will be less and less water to waste. Many of the high-head plants have ample water supply, but it is a grievous sight to see a big installation running with the streams just touching the tips of the buckets, at a head which gives every facility for cheap storage of power. Relief valves to open on a dangerous increase of pressure are often installed, but they do not seem to have been successful enough to help much in the matter of government. There is certainly a chance open for an improvement in governors that shall save all the water possible and render such an accident as forms the text for these remarks quite out of the question. Incidentally, we remark that it is a rather good plan to keep hydraulic pipes out of the dynamo room upon general principles.

## The German High-Speed Experiments.

In presenting to our readers the articles by Chief Engineers Lasche and Reichel on the preparations made for the Berlin-Zossen tests we cannot refrain from expressing our gratitude to the authors for their very full and frank explanations. The work already done represents a very large amount of invention and engineering skill, to say nothing of the expense involved, and even the preliminary account given is of immense value to the art. As to the general line of experimentation to be allowed, it is assured to be such as will bring out the facts as to high-speed work without any disguise effected by unwarrantably favorable conditions. In particular, the track is neither especially straight nor level, and being a standard piece of military road was not designed or constructed to favor speeds higher than those regularly attained on German express trains. In some respects this state of affairs is helpful in that it will fully disclose the feasibility of operating high-speed cars on lines of ordinary construction, but on the other hand, it must be recognized that a speed of two miles a minute is more a question of track and roadbed than of anything else. If the experiments result unfavorably we are disposed to think that the road rather than the equipment will be responsible for the failure. One hundred and twenty miles per hour with a 96-ton car implies very serious stresses on the track, and in this particular we could wish that the conditions were some-

what more favorable. The choice of single motor cars for the tests is likewise far from being an evasion of difficulty. There is a large amount of cumulative evidence all tending to show the advisability of using short trains rather than single cars in high-speed working. A single long motor car has very nearly as great total tractive resistance as a train of two or three times the capacity. And the more serious is their resistance the greater the relative advantage of the train. However, if a single car leads to satisfactory results, the train will take care of itself.

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We have already referred to the experiments undertaken to determine the air resistance at very high speeds. The values reached were so much higher than those indicated by any of the American experiments as to lead us to view the conditions of the German tests with suspicion, but since the motors were designed to fit the latter there is no reasonable doubt that the power supplied will prove to be ample. Four motors each of 250 horse-power normal output and capable of being forced to 750 horse-power each during acceleration, ought to be enough for all requirements. We regret that more details of these machines are not at present at hand, particularly regarding the power factors, but from the general character of the design it is safe to predict a rather favorable value at least under full load, which is the normal running condition. The performance of the motors when starting is a much more serious consideration, and although in high-speed work acceleration represents no large portion of the total energy taken, the demand for current is likely to be a severe tax on the capacity of the apparatus. It is quite safe to say that rheostatic control is by far the most feasible method to emply for such a case, and it seems to us that the rather daring arrangement adopted by the A. E. G. is likely to prove a good solution of the difficulty. For the most effective operation the resistance in the secondaries should be capable of continuous and minute variation, and when the amount of energy to be taken care of is so great as in this instance, there is much to be said in favor of liquid rheostats. In the device actually employed an additional advantage is gained by an accurate and automatic adjustment of the rate of acceleration, which should be of considerable service in reducing and steadying the starting currents. In point of fact we think that the class of service permits rather gradual acceleration, the gain in time by forcing the start being trivial on long and fast runs.

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The arrangements for braking are, we think, open to some criticism. Under the general conditions selected, the number of wheels to which brakes can be applied appears to be insufficient to ensure adequate braking at very high speeds by the ordinary methods. Neither has motor braking by return of energy to the line ever been put in really practical shape. The other alternative, energizing the motor fields with direct current and depending on the drag of parasitic currents, seems rather clumsy. In the record runs on American railways no especial trouble in braking has been experienced, but we do not think that braking down from the maximum speed was ever tried. Altogether we are disposed to think that braking a 96-ton motor car from a speed of 120 miles per hour is a much tougher problem from a practical standpoint than merely reaching that speed with it, and we should not be surprised if the solution were very troublesome. Another matter of some concern is the collection of current from the working conductors. Some doubt seems to have been raised as to the advisability of carrying the high-tension transformers on the motor car, but we feel very strongly that such is the proper location for them. They are heavy, to be sure, but the transmission system is much simplified and cheapened by carrying the transformers, and what is even more important, the volume of current which has to be taken through the flying contacts is very greatly reduced. The side-bearing bow trolleys adopted should give pretty clean contacts even at very high speed if the working conductors are properly supported, and if there is to be arcing now and then when things do not work properly the smaller the current involved the better for the contacts. We fancy, however, that the support and alignment of the three trolley wires will need considerable tuning up before everything works smoothly. A nearly straight and very smooth track would greatly facilitate this part of the work. But in spite of difficulties we think the general results will be encouraging.

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### The Electric Theory of Spectra.

An abstract in the Digest of last week related to a very interesting article by Mr. W. Sutherland, which appears in the *Philosophical Magazine* for September. The enormous complication of the spectra of material substances has, until recently, baffled all analytical investigators. It is evident that every molecule of matter must carry with it an electrical apparatus, such that when the molecule is jostled by its neighbors, i. e., when the substance is heated, the electrical apparatus sends out electrical waves into surrounding space. Under some conditions these waves have a very wide range of frequency, with nearly every frequency represented, in which case the spectrum is said to be continuous. Under other conditions, however, the electric waves emitted favor certain definite frequencies, and in extreme cases only a very few frequencies are retained. In 1885 Balmer discovered a simple formula connecting the wave lengths of the thirteen principal lines in the gaseous spectrum of hydrogen, and since that time some advance has been made in spectra a little more complicated than that of hydrogen, by determining that there existed several simultaneously existing series of wave lengths, each belonging to a family obeying the Balmer law, or possessing a particular set of constants in the Balmer formula.

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Mr. Sutherland goes to show that the Balmer and Rydberg formulæ can be accounted for by very simple kinetic hypotheses, which do not involve any precise knowledge of the nature or disposition of an atom. It is supposed that electrons, i. e., positively and negatively charged masses of matter, gyrate at an enormous constant angular velocity around an atom, and that this angular velocity is the same no matter what the nature of the atom or the substance to which it belongs. But, although the center of inertia of a positive and negative electron is supposed to travel in an orbit around the atom in the same period of time for any atom of matter, the jostlings which take place between the positive and negative electrons, and which cause electromagnetic waves to be emitted, differ characteristically with each kind of atom. Thus, when an atom of one substance is set in vibration as a whole by the heat jostling of its neighbors, stationary vibrating waves are supposed to be formed upon its surface, and the electrons in their planetary orbits around this atom will receive energy at definite periodic intervals if they strike the atom at successive revolutions, or aliquot fractions of revolutions, corresponding to the nodes of atomic vibration. Upon this hypothesis the Balmer law and its hitherto recognized extensions could be accounted for.

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Although the details of this hypothesis may require to be modified in view of future discoveries, yet it seems from the close agreement between calculation and observation afforded by the fundamental formula Mr. Sutherland arrives at, that the cause of spectra must be traced to electro-mechanical resonance, or cyclical repetition of motions of electric charges in atomic orbits. The delineation and computation of these orbits in the sphere of the infinitesimally small is perhaps more difficult than the earlier problem of delineating the planetary orbits of our sister worlds in the solar system of the enormously great. The key to the large-scale problem was found in the continued careful observation of changes in the angles between the planets and the fixed stars. The key to the supposed atomic orbits seems to lie in likewise carefully observing their nodal frequencies, as furnished from spectrum measurements.

## Exhibition at Crystal Palace, London.

Mr. Ernest Schenk, president of the Crystal Palace Company, London, is now in the United States in connection with the American Exhibition which is to be held in Crystal Palace from May to September, 1902. In course of an interview Mr. Schenk said: The forthcoming exhibition promises to be the largest and most important exposition of American products, arts, industries and inventions ever seen in Europe. It will be held under the auspices of the Executive of the American Society in London. The American advisory committee also includes a number of names well-known in business circles on this side. The list includes R. W. Blackwell, of the electrical engineering and contracting firm of Robert W. Blackwell & Co., Limited; Charles Churchill, of Charles Churchill & Co., Limited, the pioneer importers of American labor-saving devices into England; Clark Harrison, who represents the British interests of the United States Cast Iron & Pipe Company, and Colonel Millard Hunsicker, who for many years attended to the European business of the Carnegie Steel Company. The English advisory committee includes the Lord Mayor of London and Sir Douglas Fox, the ex-president of the British Institution of Civil Engineers. The exhibition includes machinery and mechanical industries, mining, electrical traction, haulage, etc.; tramway engineering and equipment, automobiles, and virtually the whole range of the arts and industries.

## Electrical Engineers of the Day—XVI.

JOHN F. KELLY.

The difficulties of writing a sketch of Mr. Kelly's life will be fully appreciated by his friends, who well know his constant avoidance of any personal reference to either himself or to his works, and in consequence the writer is compelled, for such facts as should have place in a sketch like this, to depend upon his personal knowledge of the man, or to note such as are, of necessity, a matter of record.

The ranks of those who have won distinction in developing the great electrical industry of this country to its present high state contain no more interesting nor striking figure, nor a career which has been more brilliant in action, broad in range, or solid in achievement. Mr. Kelly's name, at least to his friends, is suggestive, not only of progressive methods in electrical machinery and station design, but of successful business results.

John Forrest Kelly, at the age of 19, was graduated as a chemist from the Stevens Institute of Technology in the class of 1878. In addition to his chemical work he had time while at the Insttitue to study the subject of electrical measurements. Three years later he received the degre of Doctor of Philosophy. It is charactristic of Mr. Kelly that the title has never been associated with his name, and it is probable that not more than one or two of his friends of the last fifteen years have ever known that such a degree had been conferred upon him.

His first employment after graduating was in the laboratory of Thomas A. Edison, where he was employed as a chemist for four or five months. On leaving there in September, 1879, he entered the service of the Western Electric Company as electrician of the New York factory, and remained in that employment until January, 1882, when he resigned to take the position of assistant to Mr. Edward Weston, then chief electrician of the United States Electric Lighting Company. Towards the end of that year he left the United States Company to enter the service of the Parker Electric Lighting Company, afterwards known as the Remington Company, and remained with that company for some fifteen months, when he returned to the United States Company.

During the two following years, Mr. Kelly was closely identified with the now historical work of the old United States Company, covering not only the field of electrical machine design, but also that of the incandescent and arc lamp. In July, 1886, Mr. Weston resigned from the United States Company and Mr. Kelly was appointed chief electrician in his place. He remained in charge of all the electrical work of that company until its absorption by the Westinghouse Electric Company. With the latter company his position remained substantially similar, except in title, as he was the electrician of the Newark shops of the Westinghouse Company until his resignation, January, 1892, to join the Stanley Laboratory Company, which had just been organized in Pittsfield, Mass.

Mr. Kelly was actively connected with the Stanley Laboratory Company until January, 1895. During this period he and his associates designed the now well-known "S. K. C." alternating-current inductor generator, and arranged with the Stanley Electric Manufacturing Company to place on the market a complete system for the transmission and distribution of power by alternating currents. In 1895 he resigned from the Stanley Laboratory Company, and accepted a position as consulting electrical engineer to the Stanley Electric Manufacturing Company, of Pittsfield, and the Royal Electric Company, of Montreal, Canada, which companies were at this time actively entering the field of alternating-current work. Mr. Kelly still holds this position to the Stanley Electric Manufacturing Company, and at the same time has full charge of this company's patent work.

As an inventor, Mr. Kelly's career has been active and brilliant. Early in 1891 he showed the prejudicial effects of lagging currents on alternating-current power and lighting circuits, and in conjunction with his associates, at that time patented and developed an alternating-current induction motor having a condenser in parallel with the main motor circuit for furnishing the lagging component of the motor current. In 1892, he pointed out the value of synchronous motors on alternating-current circuits and showed that by a proper adjustment of the field, the armature current of a synchronous motor can be made to lag or lead the e. m. f. of the line as desired, and in consequence can be made to correct, not only the lagging or leading currents of the circuit, but used as a voltage regulator for an entire

transmission system. A patent for a synchronous motor used as a condenser was issued to him in 1893.

During the same year he pointed out that in the operation of alternating-current motors and also of transformers, and in the general transmission of power by alternating currents, it is of considerable importance that the currents and magnetic fluxes should vary sinusoidally, for experience had shown even at that time that the more nearly such a condition is approached the less are the losses and idle currents. A first step toward obtaining these conditions is the making of the impressed e. m. f. of the generator sinusoidal. To accomplish this it is necessary and sufficient that the magnetic flux through the armature coils should vary sinusoidally. In order to accomplish this latter result and obtain a sinusoidal e. m. f., Mr. Kelly, in 1893, designed alternating-current generators in which the poles were shaped so that the clearance or air-gap varied in an inverse sinusoidal manner, and consequently the flux and generator e. m. f. varied sinusoidally. This was probably the first attempt to shape scientifically the poles of alternators to obtain a predetermined e. m. f. wave and was the basis of a United States patent issued to him in 1894.

Among Mr. Kelly's later inventions may be mentioned the "non-hysteresis growth" transformer iron, the static ground detector and various measuring instruments. It is pertinent here to remark that he has always been an advocate of extreme voltages in transmission work and is recognized as the original "60,000-volt man."

Mr. Kelly is a member of the American Institute of Electrical Engineers, the American Association for the Advancement of Science, and the Société Internationale des Électriciens.

## A London Joint Central Station.

ONE of the features of the London, England, electric lighting industry as compared with present American practice is the existence of an extremely large number of companies each having a system of its own and differing from that of the others. For the past several years there has been some discussion as to the substitution for these stations of one or more great central generating stations which will supply the entire metropolitan area. Realization of this plan appears to be yet far in the future, but in the meantime some of the companies have entered into arrangements for the building of a joint station of modern design. Two arrangements of this kind have recently been put into effect, one by the St. James and Westminster companies, and the other by the Kensington and Notting Hill companies. We are enabled to present herewith a description of the joint plant of the two latter companies.

In 1898 both the Kensington and Notting Hill companies found themselves in urgent need of new generating stations, and neither was able to secure suitable sites within its respective supply district.

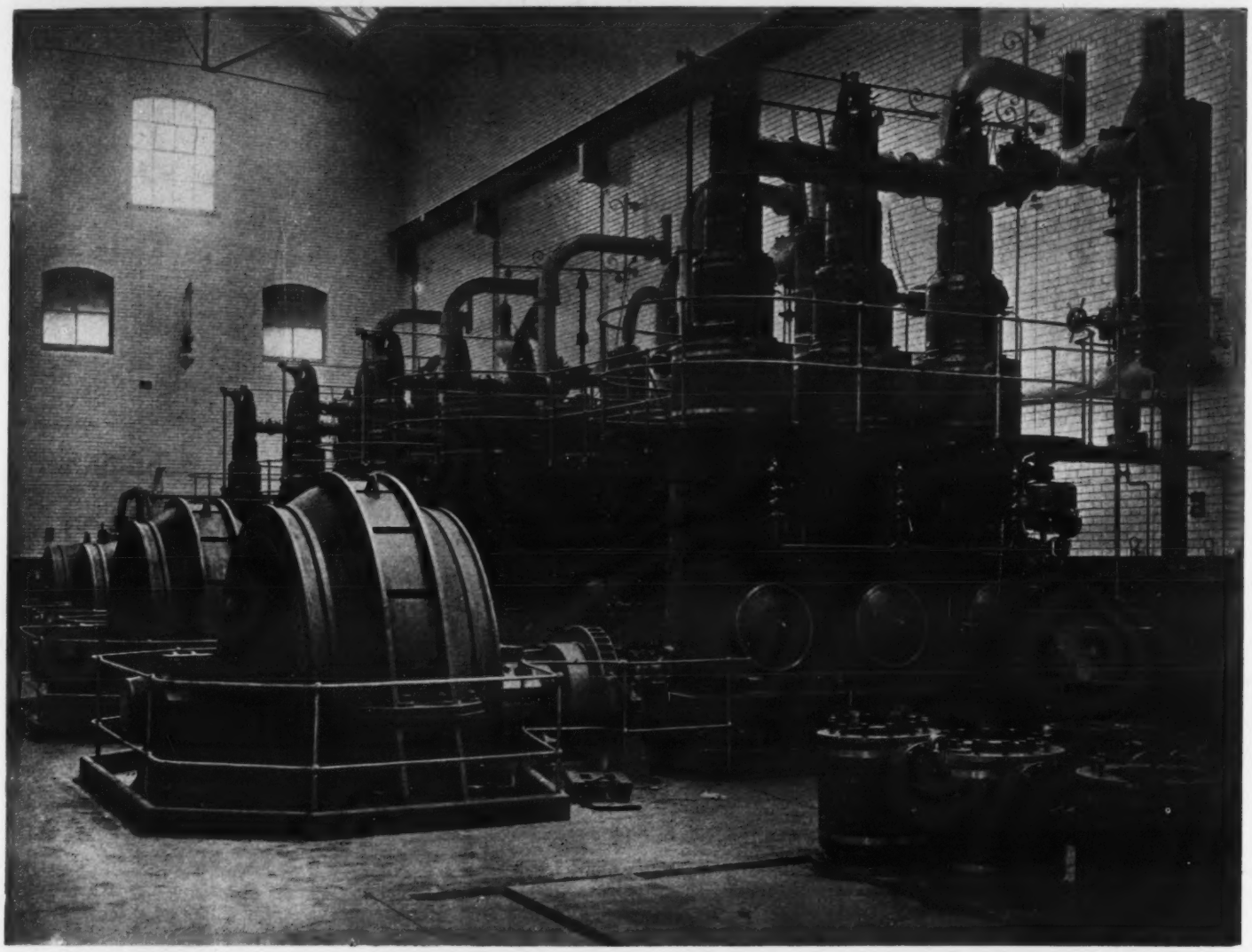


Fig. 1.—Generating Room.

As the result of negotiations the two companies decided to erect a joint station in Hammersmith, about 2½ miles from the district of the Kensington Company and 1 mile from the works of the Notting Hill Company.

Considering the distance from the areas of supply, the alternating-current system was decided upon as being the most suitable, and a pressure of 5250 volts at the generating station, with three-phase generators was chosen. Both companies are supplying current under somewhat similar conditions, the three-wire system being used with 220 volts pressure between the outers, whilst in each case special facilities are being given to consumers to change over to the higher pressure, and no houses are being connected at 110 volts, so that the companies hope in the future to change to a three-wire system at 440 volts. At present, however, all the switchboards and generators are made for 220 volts, the balancing being done by existing accumulators at the Kensington Court and Bayswater Road sub-stations; whilst at the new sub-stations of both companies only 220-volt motor-generators are being installed, no arrangements being made for balancing, as supply in their neighborhood is almost altogether at the single voltage. The question of using rotatory transformers, synchronous motor-generators or induction motor-generators was very carefully considered, and it was decided in the first instance to use nothing but the last-named type of machine in the sub-stations. The principal advantage of using the induction motor-generator is on account of the exceedingly rapid increase of load that always occurs in London, and, in fact, in most large towns, due to either a thick fog or a heavy thunderstorm. Speed in starting fresh motor-generators is consequently a great desideratum, and the induction motor-generator can be switched on to the mains within two minutes of starting up. It also takes the whole of the starting current from the supply station, whilst in the case of the synchronous motor-generator the starting current is taken from the side already fully loaded. The mains have been laid with a very wide margin for increased output, so the question of power factor was not considered of prime importance; and, if found necessary, synchronous machines will be installed when extensions are necessary.

An area of 3¾ acres was acquired on which a boiler house and engine house, each 126 ft. by 45 were erected. On the grounds are sidings from two railroads. The walls of the buildings are faced with special leadless white glazed bricks, with a brown dado and black line formed to a height of 6 ft. above the floor, which is of concrete covered with a maple block flooring. The boiler house roof is constructed with non-inflammable wood and steel, and slated outside. Boyle's air-pump ventilators are fixed on the ridge of the roofs of both engine and boiler house.

The chimney has been designed to deal with the flue gases from boilers of 10,000 horse-power. It is 230 ft. high and 210 ft. above the

ground. The section is circular, with an 11-ft. bore throughout. The excavation was taken down 26 ft. until the hard blue clay was reached, this depth being 13 ft. below the standing water level. The outside diameter varies from 22 ft. at the bottom to 13 ft. 4 inches at the top.

The boiler house provides space for eight Babcock & Wilcox boil-

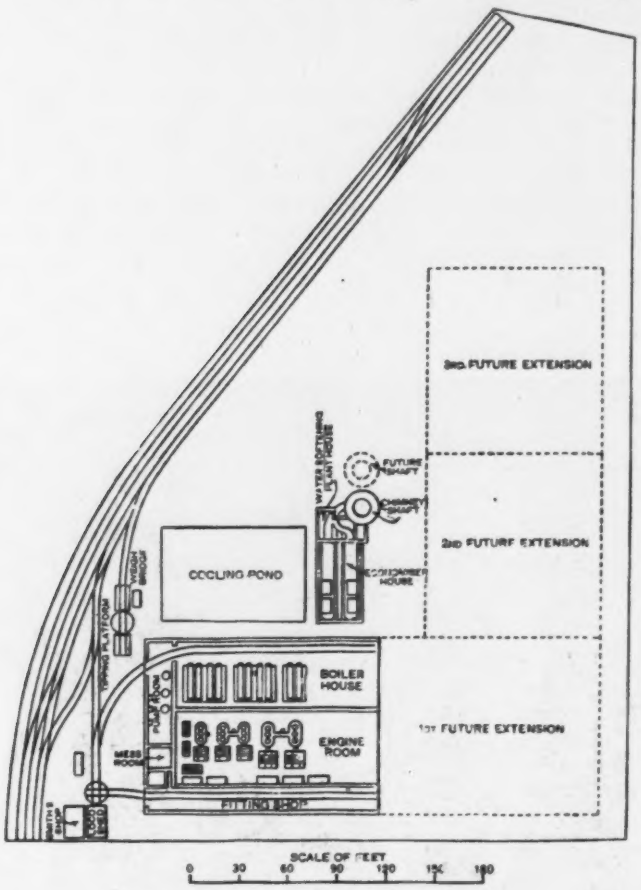



FIG. 2.—PLAN OF GENERATING STATION.

ers, each having 3654 square feet of heating surface and capable of evaporating 14,000 lbs. of water per hour at 200 lbs. pressure, which is the working pressure. The boilers are equipped with Babcock & Wilcox self-clinkering grate mechanical stoker, the stoker gear being driven by a 5-hp motor. A complete coal and ash-handling system is installed. The coal is delivered to storage bunkers directly over the boilers, 108 ft. long, 17 ft. wide and 17 ft. deep, and capable of storing 800 tons. Measuring chambers are employed similar to those which have been used with such great success in gas works. Owing to the tubes in the boilers having to be taken out, it is arranged that the chute may be swung out of place so as to allow of the tubes being withdrawn without disturbing the coal in the bunkers. Each of the chutes holds 10 cwt. of coal, and is provided with flap doors so that the capacity may be adjusted from time to time, according to

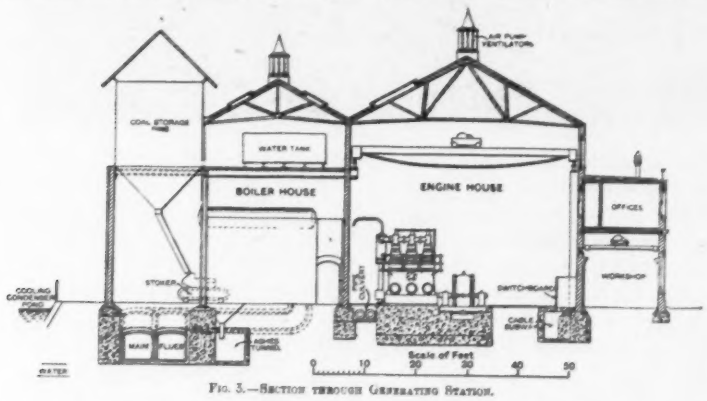



FIG. 3.—SECTION THROUGH GENERATING STATION.

FIG. 3.—SECTION THROUGH GENERATING STATION.

the quality of the coal which is being used, and to the lever is connected a counter so that the number of discharges are registered. In addition to this, the chutes are provided with a Graham patent sure-feed, which is a simple and efficient device for preventing the chambers being half-emptied or being tampered with, and the slide having been once withdrawn must remain open until the whole of the coal is discharged. The whole plant is designed to deal with 30 tons of coal per hour, and is driven by two 10-hp electric motors.

A complete set of apparatus has been provided for testing coal and for boiler trials. It consists of a 2-inch Schonheyder's high-pressure

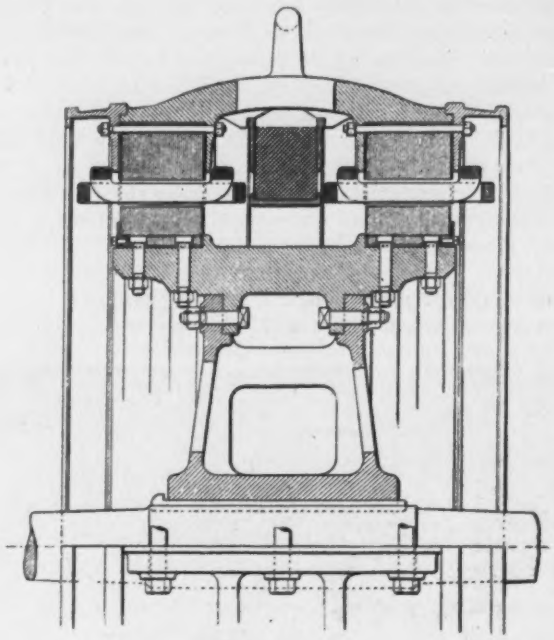


FIG. 4.—SECTION THROUGH 330-KW ALTERNATOR.

water meter, weigh-bridge for the coal, dasymeter for measuring the $CO_2$ draught gauge, and pyrometer.

Water is obtained either from the water company or by means of a three-throw electrically-driven pump from a well on the grounds. A water-softening plant has been fixed near the economizers capable of dealing with 1500 gallons of water per hour.

Over the boilers are two cast-iron tanks, measuring 112 ft. long by 16 ft. wide by 6 ft. deep, and holding about 55,000 gallons of water, so that at full load the tanks contain half an hour's supply. These tanks give the necessary head of water required by the ejector condensers fixed on each engine, and are filled by one of the circulating pumps, the steam valve on the pump being controlled by a float in the tank.

A cooling pond, measuring 100 ft. by 60 ft. by 7 ft. deep, has been excavated, the bottom being in a thick bed of clay. It has been lined with cement concrete and Callender's bitumen sheeting; 84 jet foun-

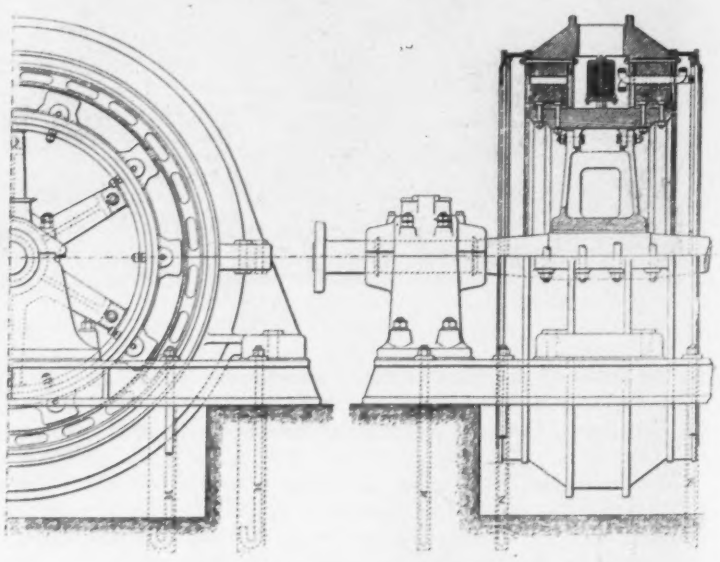


FIG. 5.—550-KW ALTERNATOR.

tains have been fixed. The pond was designed to deal continuously with the condensing water from about 2500 horse-power, and the water pipes will still be large enough when the pond is increased to twice its present size. The water is pumped to the fountains under a

head of 150 ft., and the whole of the rainwater collected on the roofs is delivered into the pond.

The arrangement of the engines and dynamos is shown in Figs. 2 and 3, whilst the general appearance of the engine room may be seen from Fig. 1. Five sets have so far been installed, and there is still space in the existing building for two larger sets. The smallest unit adopted consists of a 575-hp Willans engine, coupled to a 330-kw Oerlikon alternator, which runs at 300 r. p. m. Three of this size have been fixed, as well as two larger sets. These latter indicate 825 horse-power, and are coupled to 550-kw alternators running at 270 r. p. m. All the engines are of the three-crank triple-expansion type, and each engine is fitted with a Korting ejector condenser, the condensers taking their water from the tanks over the boiler house. The discharge is taken through a 20-inch cast-iron pipe through the pump room to the cooling pond.

The engine cylinders are lubricated by means of pure powdered graphite mixed with a small quantity of cylinder oil to form a thick paste. This mixture is put into a grease lubricator, such as is used for forcing grease along pipes to the bearings of engines. The piston of the lubricator is forced down by means of a worm wheel and worm geared to a ratchet wheel, the ratchet of which is given a reciprocating movement from a speed reducing gear driven by belt from the crank shaft. The speed is set so as to give one drop per minute to the engine, the graphite being fed through small copper pipes. One of these lubricators will last for two months without refilling.

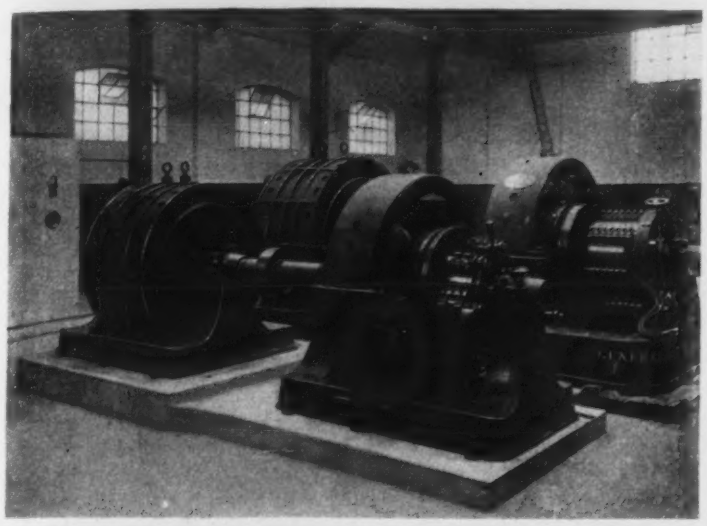


FIG. 6.—LANCASTER ROAD STATION.

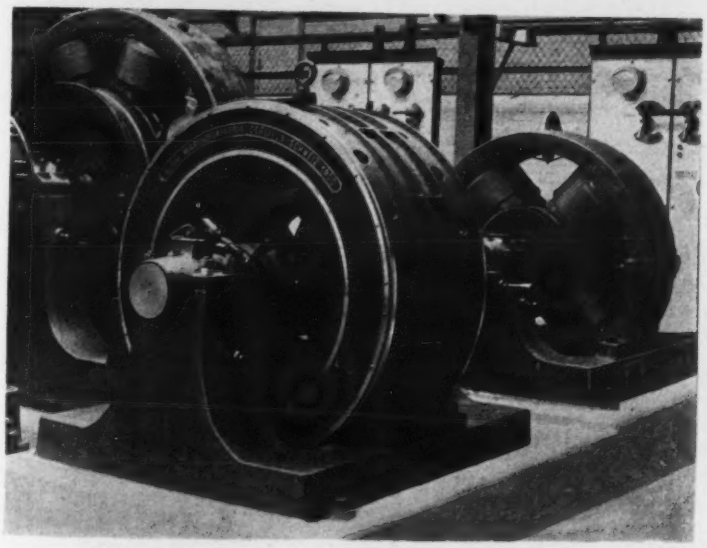


FIG. 7.—HIGH STREET STATION.

The alternators are of the three-phase inductor type working at a pressure of 5250 volts at 45 cycles per second. Fig. 5 gives a half elevation end of the 550-kw alternator, and a side view half in elevation half in section of the same machine, and Fig. 4 is a section through the 330-kw machine.

In the case of the smaller machine the inductor is 5.94 ft. in diameter, and the stator is bored out to a diameter of 5.96 ft., giving a clearance of about ⅛ inch between rotor and stator. The poles are of laminated charcoal iron. The hub and spokes of the rotor are of cast-iron, and the rim is of steel. The outer rim of the stator is of steel, and the magnet spool is of cast iron. The steel shaft is 8.66 inches diameter, tapering to 6.7 inches at the bearings. The diameter of machine over all is 8.2 ft., the length is 9.7 ft., and the width 9.84 ft. The 550-kw machine is very similar in construction, with the exception that the outside rim of the stator is of cast iron, and the field-magnet bobbin is divided by a wrought-iron separator.

The exciting current can be taken either from two Willans-Parker generating units, a motor-generator or a battery of accumulators. The exciters have an output of 40 kilowatts at 450 r. p. m., the engines being of the two crank triple-expansion and condensing type. The accumulators have a capacity of 600 ampere-hours. There are 56 cells, and these may be used also for lighting or working the auxiliary motors in the station. The motor-generator has an output of 600 amperes at 100 volts, and is similar to those in the sub-stations, described below.

The switchboards are in five separate sections, and consist of (1) the low tension board, for the exciters, lighting, power and accumulators; (2) the panels for the three 330-kw alternators and the motor-generator; (3) the panels for the trunk mains to the Notting Hill Company's district; (4) the panels for the two 550-kw alternators and two spare panels for extensions; (5) the panels for the trunk mains to the Kensington Company's district. The general arrangement of the boards is clearly shown in Fig. 13. The alternator panels are on the left and the motor-generator panel on the right.

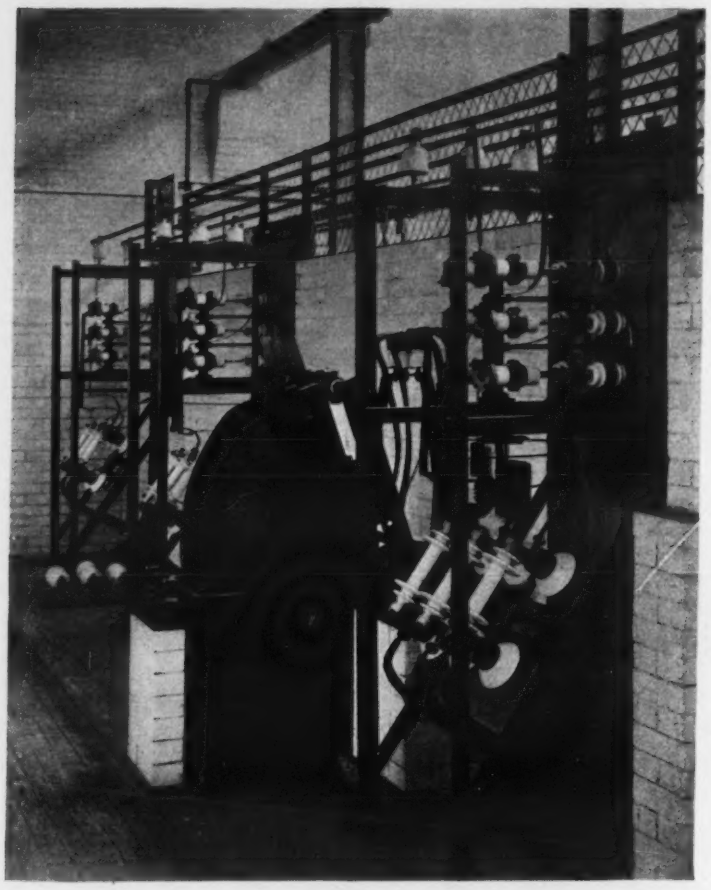


FIG. 8.—REAR VIEW HIGH-TENSION SWITCHBOARD, HIGH STREET STATION.

In designing the switchboards an endeavor was made to render them safe from accidental contact with any live part. On the front of the high-tension panels and exposed to view are only the instruments and switch handles. The dials of the instruments are seen through holes cut in the marble panels. The glass covering the dial is the only part that can be touched, and this is surrounded by a metal ring connected to earth, as also is the three-pole main switch handle. At the back of the boards the iron framework is formed into cages, one for each panel, and provided with iron doors fitted with Yale locks; but it is possible to go into the space at the back of the boards and look at the apparatus through the iron meshing. The switches

and bus-bars overhead have similar ironwork guards to stop any one reaching up to them. In the event of any of the apparatus at the back of the panels requiring adjustment, it is the duty of the engineer in charge to cut off the current from the particular panel by means of the main switch, and lock it with a Yale lock. The door of the cage may then be opened.

At the bottom of the cage of a 550-volt panel is a smaller cage, which contains the synchronizing transformer. Above this is the resistance and 50-contact rheostat controlling the current through the field magnet. In the center are the three main fuses, synchronizing switch fuses and the voltmeter switch. The main three-pole switch is in the cage above. The feeder panels are separated in a similar manner, but in these the fuses are of a somewhat different pattern. Both types consist of weighted copper wires in asbestos tubes with ebonite handles. With the exception of a few electrostatic Kelvin voltmeters, the instruments are mostly of the Hartmann and Braun hot-wire pattern. In the case of the synchronizing voltmeter there are two scales, one showing the pressure of the bus-bars, the other of

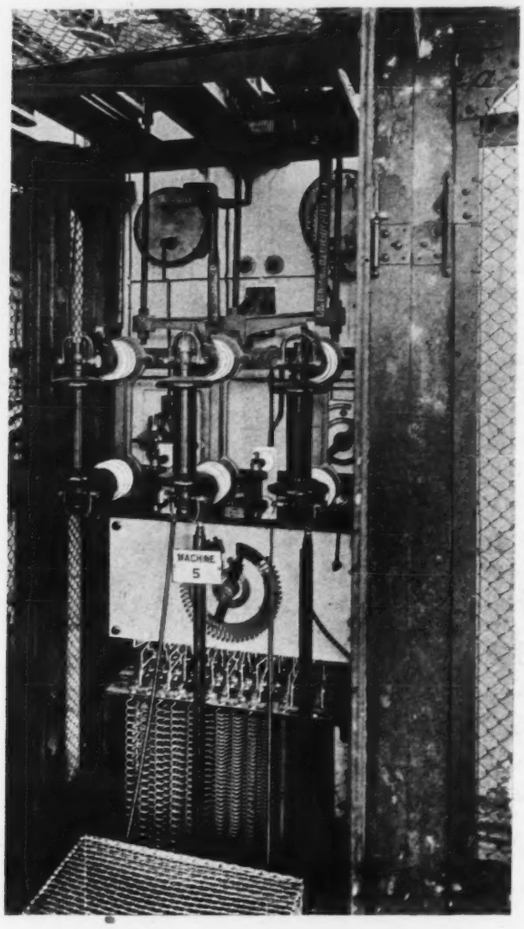



FIG. 9.—550-KW ALTERNATOR PANEL.

the incoming alternator. A Thomson three-phase voltmeter is fitted in each circuit panel and is provided with a needle to indicate the load on the feeder. The whole of the insulators on the boards have been tested up to 20,000 volts.

The feeders from the generating station to the sub-stations are all in duplicate. They are of the clover leaf pattern, taped and drawn into Doulton casing, each conductor being 0.15 square inch in area. Under the switchboards the cables are laid beneath the floor of a cable subway constructed the whole length of the engine house. The mains then pass into the conduits, which are surrounded with 6 inches of concrete. They are carried under and across the lines of the West London and the Hammersmith and City Railways into Hunt Street, and then away to the two companies' districts. Ten out of 12 cables have been drawn in, and before use they were tested up to 10,000 volts for half an hour to earth and half an hour between each of the cores.

The motor-generators used both by the Kensington and Notting Hill Companies are of the Oerlikon induction-motor type, their general appearance being clearly shown in Figs. 6 and 7. The motors have wound rotors, which are provided with slip rings for connecting to the starting resistance. These resistances are placed between motor

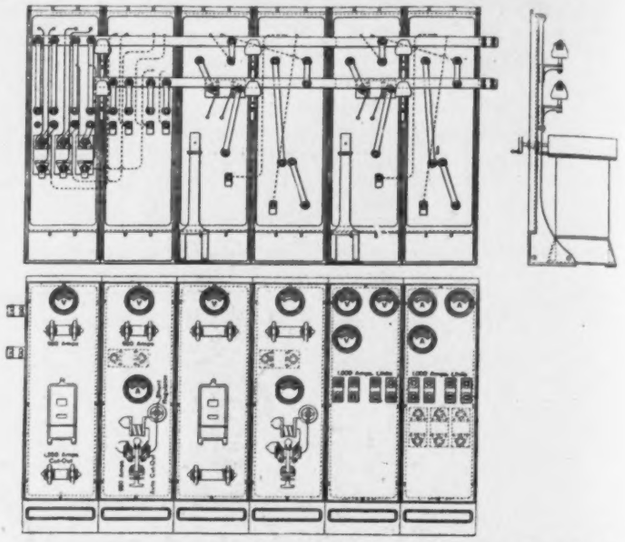


FIG. 10.—LOW-TENSION SWITCHBOARD, LANCASTER ROAD SUB-STATION.

and generator at the Kensington sub-stations and near the switchboards by the Notting Hill Company. When the motor has reached full speed and the rotor resistance is cut out, the brushes can be removed from the slip rings by means of a lever, shown to the right of the motor in Fig. 6. The clearance between the rotor and stator is about 1-16 inch, and liners are used to correct for wear of the bearings. The generators are of the multipolar type with cast-steel yokes, and the field magnets can be excited directly from the brushes or from the bus-bars. Copper gauze brushes are used with one leading carbon brush to each set. The large dynamos have barrel-wound armatures, whilst for the smaller sets evolute end connections are used.

SUB-STATIONS.

The sub-station of the Kensington Company is in vaults at the back of Albert Hall. The present equipment consists of one 100-kw,

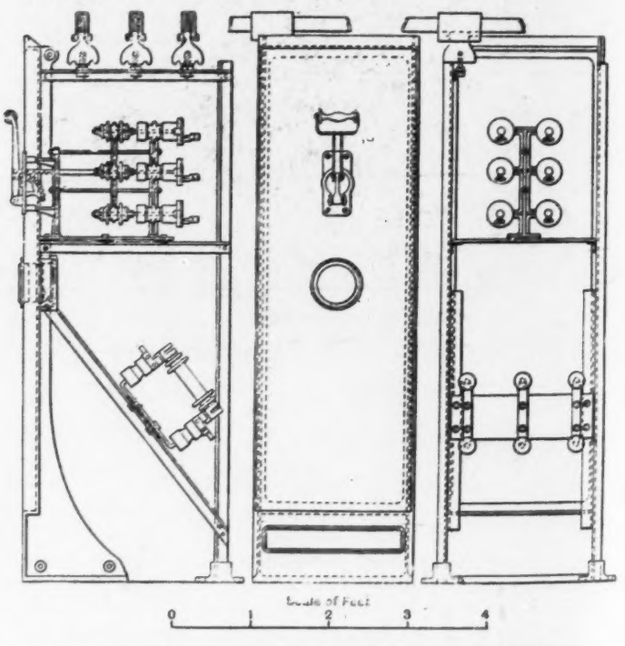



FIG. 11.—HIGH-TENSION PANEL, NOTTING HILL SUB-STATION.

two 180-kw and three 200-kw machines. The smallest-sized unit runs at 420 revolutions and the larger ones run at 380 revolutions.

Four cables from the generating stations enter the sub-station, and are divided into separate cables in joint boxes. Fuses are in circuit

with each cable. The high pressure switchboard is similar in design to that at Wood Lane, and caged in the same way, but there is an additional precaution, the fuses being separated by slate slabs. The bus-bars consist of copper tubes which form a ring main, and they can be disconnected at three places. The three cables to each motor have a lay of about one turn in 10 ft.

On the low-tension board are six generator panels and four feeder

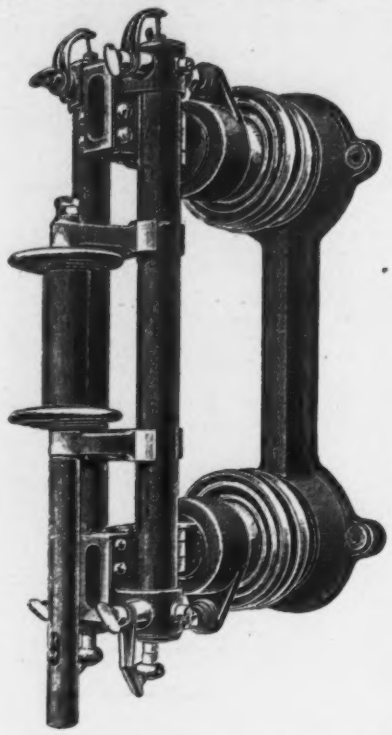


FIG. 12.—TYPE OF HIGH-TENSION FEEDER CUT-OUT AT WOOD LANE AND KENSINGTON SUB-STATIONS.

panels. The fuses are of copper shunted with a small tin fuse in a fibre tube. The instruments are of the Evershed moving coil type. Motor-generators are also being installed at the Kensington Court station.

The Notting Hill Company has made its first sub-station on the same premises as its generating station in High Street, Notting Hill Gate, but it has now nearly completed a second in Lancaster Road. A portion of the first sub-station is shown in Fig. 7. In the Notting Hill sub-station two 60-kw, two 180-kw and one 300-kw motor-generators have been installed, and there is room for one further 300-kw set. In the Lancaster Road sub-station one 100-kw and one 180-kw sets are being erected, the last-named having the generator of the Byng-Hawkins type, which was made in England, the others the General Electric Company obtained from Switzerland.

switches have a total double break of about 12 inches. This takes place inside a porcelain tube and there is practically no arc. The fuses are of the popgun order with a break of about 8 inches. The actual fuse is made of silver, as this metal is found to be the most reliable, a given size of wire breaking nearly always with the same current; they are inclined so that the fuse and plug are shot in a direction where they will not cause damage.

The rotor of the 300-kw motor-generator is started by means of a water resistance, the starting current being about 700 amperes. A tell-tale, giving the position of the resistance plates is fixed on the wall above the regulating handle.

Each sub-station is in direct communication with the Wood Lane station, the signaling being carried out either by telephone, telescriptor or bell. In the main station there are two separate sets of apparatus, one for each company's sub-stations, and these are placed in chambers between the switchboard sections.

The consulting engineers for the plant were the chief engineer of each company, Mr. H. W. Miller, of Kensington, and Mr. G. Schultz, of Notting Hill, the specification and construction of the joint station being also undertaken by these gentlemen, who were assisted by Mr. C. M. Bennett and Mr. S. F. Weston; and when the work was completed Mr. Bennett was appointed resident engineer, with Mr. Weston as his chief assistant. We are indebted to our London contemporary, the *Electrician*, for the data contained in this article.

## Storage Batteries in Traction Work.

In a discussion of the paper read at the Street Railway Convention by Mr. W. E. Harrington, an abstract of which appeared in our issue of last week, Col. Heft said that he was sorry that his experience with storage batteries had not been very satisfactory, and that he could not recommend installing batteries. Mr. Uhlenhaut said that the cost of maintenance of a battery depended upon its capacity for the work required of it. He referred to two cases, in one of which the battery had been in use for four years with practically no depreciation; another had been expensive in maintenance, and an investigation showed that this latter was overworked. Mr. Wason said that in the arrangement of sub-stations something may be sacrificed in the location of the battery from the engineering point of view in order to install it at a point where it could receive attendance without extra charge. Mr. Davidson, of Pittsburg, agreed with Mr. Wason, and said that the company with which he is connected has chosen three points for sub-stations on a long line, such that the batteries will require scarcely any expense for attendance, as other operations are carried on in the same premises. Professor Roberts said that the Union Traction Company, of Indiana, had found that their storage batteries act as lightning protectors. During heavy storms the boosters are thrown out of circuit and the batteries then serve as efficient lightning protectors. Mr. Crosby said that in Washington the storage batteries installed near the center of the city are able to

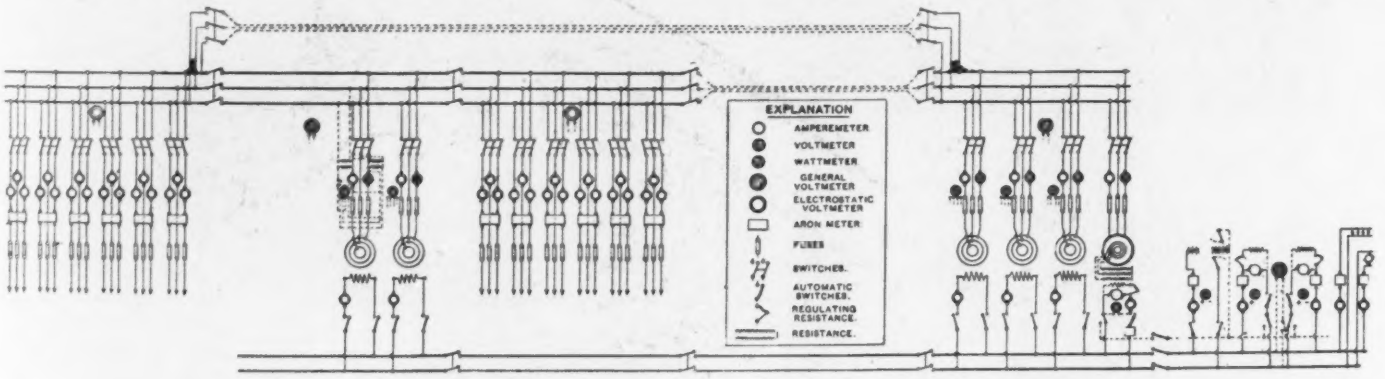



FIG. 13.—GENERAL ARRANGEMENT OF SWITCHBOARDS AT WOOD LANE.

The principal difference between the Notting Hill station and the Kensington station is in the switchboards. In the sub-station now working the panels are opposite the machines. The high-tension panels are separated by white glazed brick walls, the whole working apparatus being practically enclosed in a separate room with a locked door. The low-tension panels are placed in front with a clear footway between, and the backs are quite open. The high-tension boards are of the standard Oerlikon pattern for this class of work. The

carry 75 cars for a period something like six hours, should, by accident, the station capacity be put out of commission. When this has occurred there was a heavy drain on the battery, but it did its work satisfactorily. He considered that the surroundings of battery installation have something to do with its efficiency, and mentioned one case where a battery confined in a dark confined space had a disastrous repair account, while another battery properly installed had a repair account which was quite favorable.

# The Inductor Alternator—III.

BY EDWARD HEITMANN.

(*Concluded.*)

IN the preceding article the constructional details of an inductor alternator were given. The accompanying illustrations show some of the more general features.

Fig. 7 is a 1200-kw, 200-r. p. m. inductor alternator, built for direct connection to a waterwheel. Fig. 8 is a large engine-type generator, built to operate at a speed of 100 r. p. m. The construction of the poles characteristic of S. K. C. generators is very well illustrated in this, and other details are also plainly shown. The characteristics of this machine will be given later.

Sometimes in large high-speed generators it becomes impossible for mechanical reasons to use the "magnet bar" construction. The type illustrated in Figs. 9 and 10 is then resorted to. The inductor does not differ from that described before. For the armature, a cast steel ring, as shown, takes the place of the magnet bars and end rings, while the punchings are held in place by means of dovetails and keys similar to those described for securing the pole punchings. In all other respects, this type corresponds with that previously discussed.

Fig. 10 is a 2000-kw, 240-r. p. m. of this type, built for direct-connection to a waterwheel. The characteristics will also be given later.

## CURVES AND DATA.

In Fig. 11 are given the saturation curve and regulation curves of a 500-kw, 2500-volt, 60-p. p. s. engine-type inductor alternator designed to run at a speed of 100 r. p. m. The saturation curve is plotted with field currents as abscissæ and volts as ordinates. The regulation curves are plotted with armature currents as abscissæ and volts as ordinates, and show the rise in volts when a given load at power factors from 100 to 70 per cent and 2500 terminal volts is thrown off. For instance, if the generator is carrying its full load of 100 amperes at a power factor of 100 per cent, the e. m. f. will rise to 2640 volts when this load is removed. Thus the regulation is 5.6 per cent on full non-inductive load. This regulation was determined from a test made after the generator was installed, and from the data obtained, the other regulation curves were calculated. The curves are also useful in determining the field current required for a given load and power factor, as follows:

Assume 100 amperes armature current and a power factor of 100 per cent. Starting at 100 amperes on the lower scale, follow this line

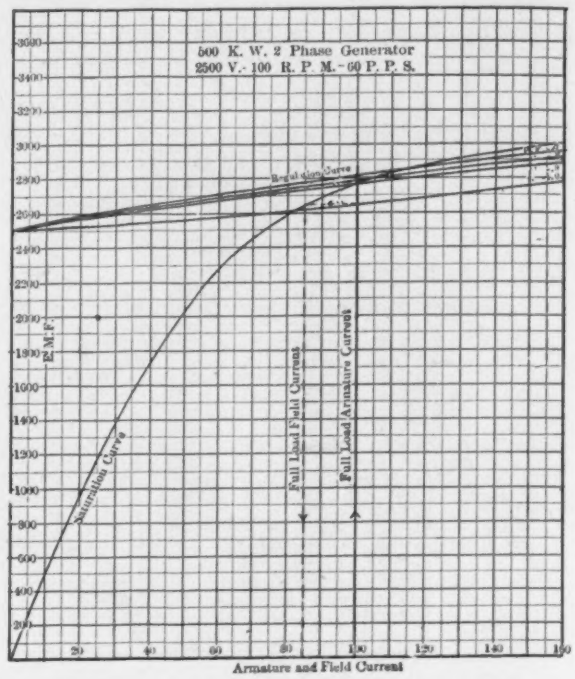

500 K. W. 2 Phase Generator
2500 V.- 100 R. P. M.- 60 P. P. S.
Regulation Curves
M. F.
Saturation Curve
Full Load Field Current
Full Load Armature Current
Armature and Field Current

FIG. 11.—SATURATION AND REGULATION CURVES.

upwards until the regulation curve for 100 per cent power factor is reached, then horizontally to the left to the point of intersection with the saturation curve, which will indicate the required field current. From the curves we obtain the following data for full load output:

| Power factor. | Regulation. | Field current. |
|---|---|---|
| 100 per cent. | 5.6 per cent. | 85 amperes. |
| 90 " | 10.5 " | 100 " |
| 80 " | 11.6 " | 105 " |
| 70 " | 13.0 " | 110 " |

The no-load field current is 79 amperes and the increase in field

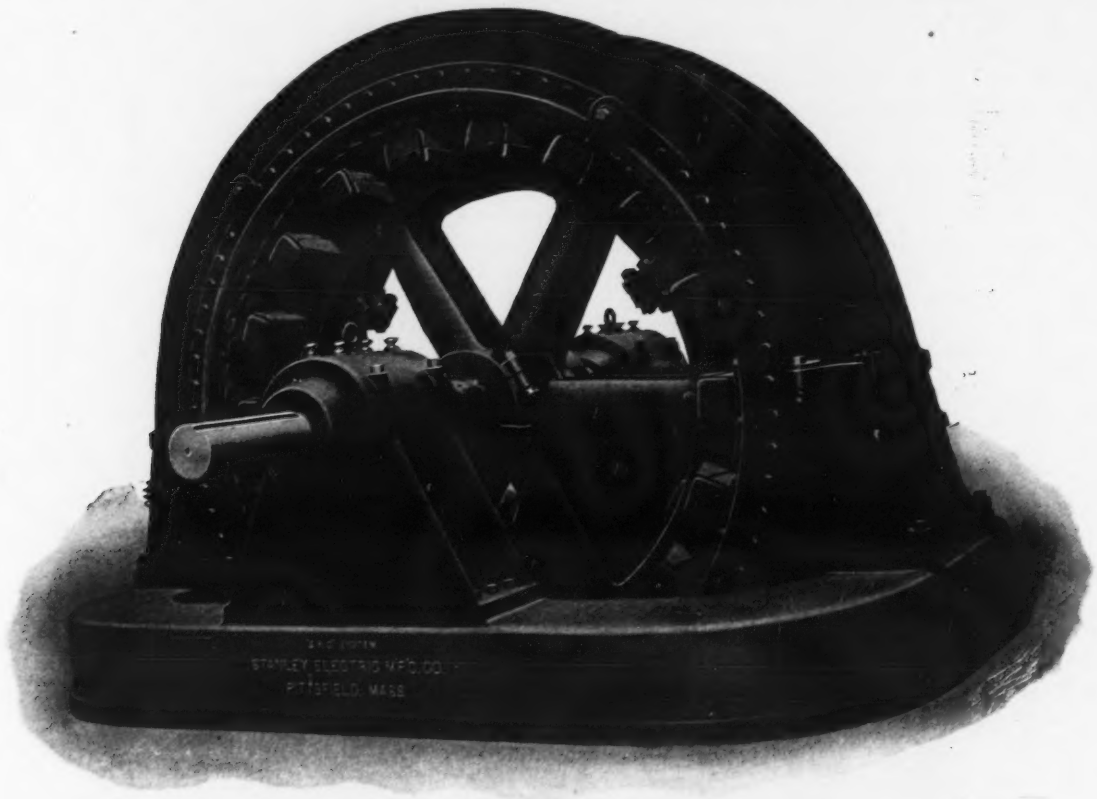



FIG. 7.—1200-KW INDUCTOR ALTERNATOR.

current from no load to full load at 70 per cent power factor is about 40 per cent. This generator will carry 100 per cent load continuously with a temperature rise of 40 degs. C. It will carry 125 per cent load continuously, with a temperature rise of 50 degs. C. and carry 150 per cent for three hours.

FIG. 8.—ENGINE TYPE GENERATOR.

The efficiencies are as follows:

| Per Cent Load. | Per Cent. |
|---|---|
| 125 | 94.6 |
| 100 | 93.8 |
| 75 | 92.7 |
| 50 | 91.0 |
| 25 | 86.0 |

In Fig. 12 similar curves are given for a 2000-kw, 2200-volt, 60-cycle generator designed for direct connection to a waterwheel operating at a speed of 240 r. p. m. The non-inductive regulation was determined as before and the remaining calculated. The data obtained from the curves is as follows for full load:

| Power Factor. Per cent. | Regulation. Per cent. | Field Current. Amperes. |
|---|---|---|
| 100 | 3.0 | 154 |
| 90 | 8.2 | 174 |
| 80 | 11.0 | 180 |
| 70 | 11.4 | 187 |

The no-load field current is 146 amperes at 2500 volts, thus the increase in field current from no load to full load at a 70 per cent power factor is about 30 per cent.

This generator will carry 100 per cent load continuously, with a rise in temperature of 35 degs. C. It will carry 125 per cent load continuously with a rise in temperature of 45 degs., and will carry 150 per cent load for four hours. The efficiencies are as follows:

| Per Cent Load. | Per Cent. |
|---|---|
| 125 | 95.0 |
| 100 | 94.75 |
| 75 | 93.5 |
| 50 | 92.0 |
| 25 | 89.0 |

The following results were obtained from load tests, both non-inductive and inductive. The first test was made on a 90-kw, 900-r. p. m., two-phase, 60-cycle generator, loaded on a water rheostat. The regulation was found to be 10 per cent for full non-inductive load. Sufficient reactance was then put into the circuit to lower the power factor to 65 per cent. The full-load regulation measured was 23.5 per cent, that is, 2.35 times the non-inductive. Similar tests made on a 60-kw, three-phase alternator showed a regulation of 10.6 per cent on full non-inductive load and 23.8 per cent on full load, 76 per cent power factor, or about 2¼ times the non-inductive.

In conclusion, I will give complete data on a 135-kw, 2400-volt inductor alternator, designed to operate at 60 cycles and 900 r. p. m.

All figures and curves were obtained from actual tests of the machine. The non-inductive load tests were made with a water rheostat, the inductive load test with rheostat and reactive coils. All the voltmeter, ammeter and wattmeter measurements were made in the ordinary manner with S. K. C. hot wire and Weston instruments, which were carefully calibrated.

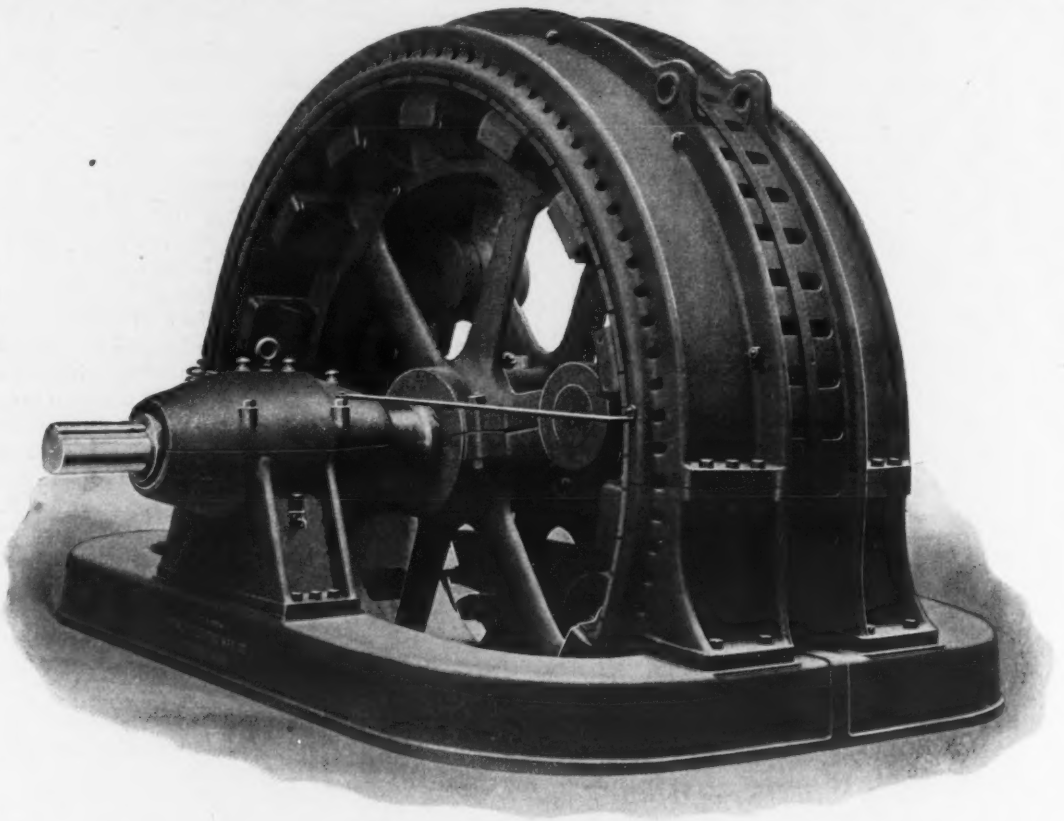


FIG. 9.—ENGINE TYPE GENERATOR.

The full load armature current is 28.1 amperes; the full-load field current, 8.8 amperes. The hot armature resistance is 14.6 ohms per phase. The hot field resistance, 9.35 ohms per phase. Measured windage and friction equals 2000 watts and measured iron loss equals 5000 watts.

Fig. 13 gives an efficiency curve calculated from these data. The

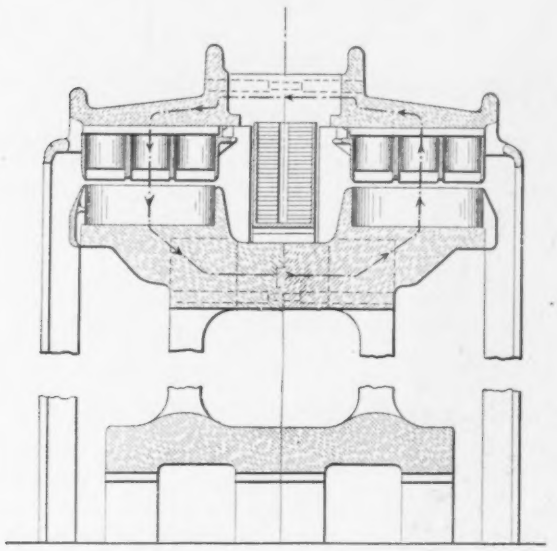


FIG. 10.—SECTION OF GENERATOR SHOWN IN FIG. 9.

full-load efficiency is 93 per cent; for three-quarter, 92 per cent; for half load, 90½ per cent, and one-quarter load, 81½ per cent.

The regulation, from full non-inductive load to no load, is 9 per cent, and for full load, 70 per cent power factor, is 21.8 per cent, or less than 2.5 times the non-inductive. In Fig. 13 the regulation curves for 100 per cent and at 70 per cent power factor are given, as well as the saturation curve.

The generator on which the above tests were made was not especially designed for service on inductive circuits, but a standard ma-

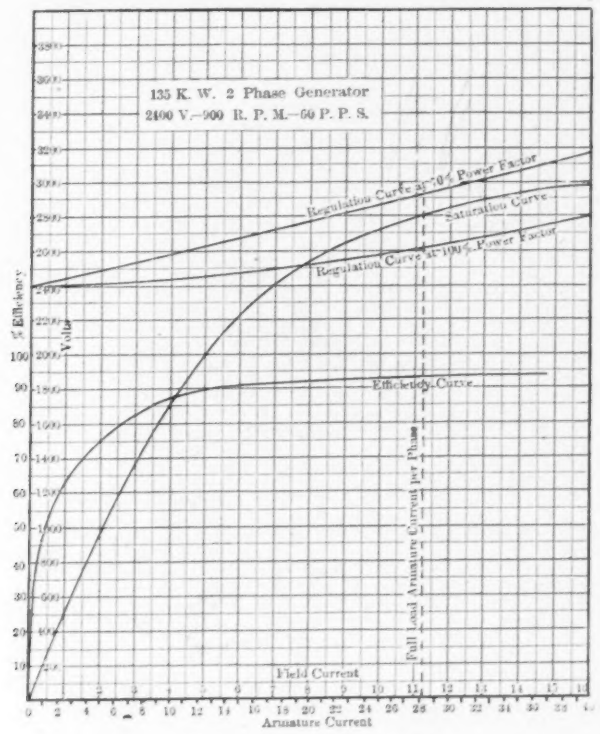



FIG. 13.—EFFICIENCY AND REGULATION CURVES.

chine, and was chosen for this test merely because it was most convenient to use it at the time.

The tests, as well as those given above on other generators, undoubtedly show that an inductor alternator, when properly designed and dimensioned, will successfully meet the most severe conditions met with in its practical operation, and that its behavior under such

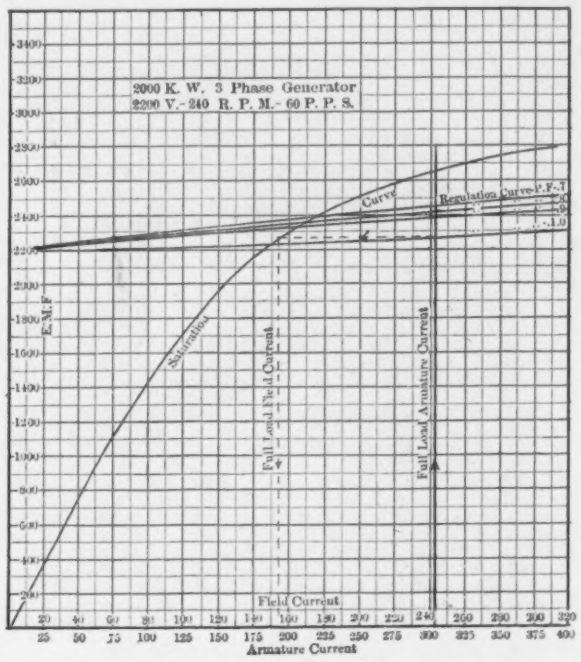



FIG. 12.—CURVES OF 2000-KW GENERATOR.

conditions will be equally as good, if not better, than that of any other type.

## The Influence of Polyphase Apparatus on the Design of Railway Power Stations—III.

By J. E. WOODBRIDGE.

*(Concluded.)*

### GENERATING STATION ARRANGEMENT.

The arrangement of the apparatus in a steam power station is, of course, fundamentally determined by the requirements of the piping. In order to illustrate the influence of electrical apparatus on such a structure we will again construct as nearly as possible a representative case. We will assume that the power station, as a whole, consists of the usual boiler and engine rooms parallel with each other, with a single row of cross-compound engines in the engine room, with their shafts in line and with their cylinder heads projecting toward the boiler room wall.

For best operation all steam auxiliaries, such as condensers, pumps, etc., should be kept in the boiler room side of the engine room, leaving the opposite side of room clear for the electrical auxiliaries.

The location of switchboard and other electrical apparatus at one end of engine room is not to be recommended, owing to difficulties in extension, as well as length of leads and distance from machines in opposite end of room. The distribution of electrical apparatus along the opposite side of engine room from boiler room wall almost invariably gives the best results.

Owing to the large number of oil switches usually needed in a generating station, it is, as a rule, necessary to place them in two parallel rows behind the switchboard, unless they are forced into the basement or on to a gallery, both of which arrangements work out less satisfactorily in detail than the double row behind panels. The two rows of oil switches call for a depth behind the panels amounting to about 13 ft. As the space usually left between engines and side of engine room does not amount to as much as this, it appears at first sight necessary to build an offset from the building for this apparatus. However, the exciters, transformers, converters and other apparatus which these stations generally contain serve, with offices, and possibly a stock room and oil room, to extend this offset the whole length of engine room, making good use of a rectangular piece of property. Since the traveling crane need not span the electrical auxiliaries, these can be placed in a sort of lean-to outside the

crane and roof-supporting columns, thereby saving considerable in cost of crane and main roof trusses.

Such an arrangement is indicated in Figs. 13 and 14. These show a lean-to, with a width of about 10 ft., containing a switchboard at

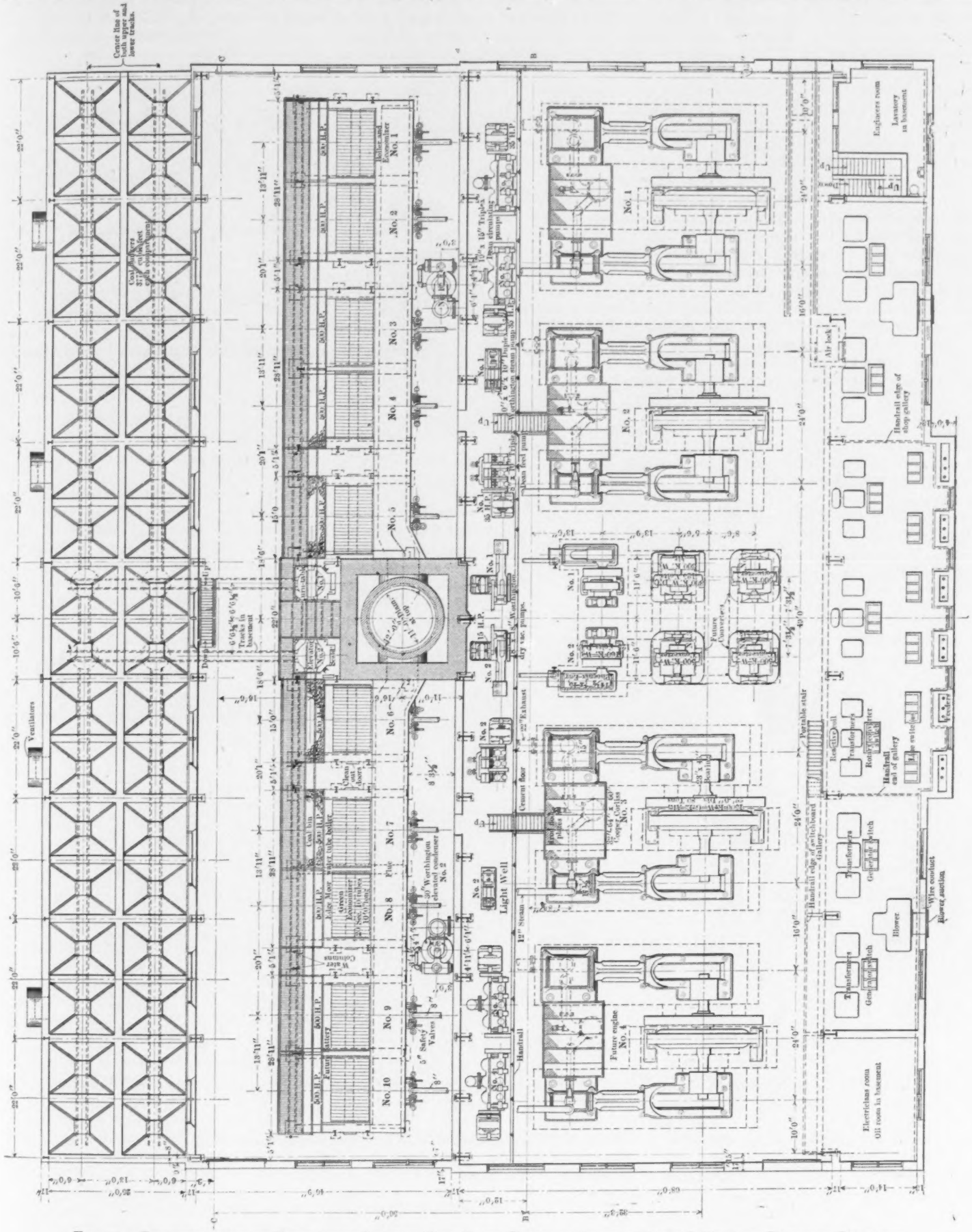



FIG. 12.—COMPLETE PLAN OF GENERATING STATION NOW BEING BUILT BY AURORA, ELGIN & CHICAGO RAILWAY COMPANY.

about the middle of the station, with the exciters to the left of this switchboard and converters to the right. This particular station is one equipped with high-potential generators calling for step-down transformers for the converters. The exciters consist of one engine-driven machine for starting up the plant and for use as a reserve and one induction motor-driven machine for steady use. These machines are located to the left of the switchboard, since it is customary to mount the exciter panels at this end of the switchboard structure. The converters are mounted to the right as near as possible to their respective panels, which are at that end of the board. It

might be noted here that a switchboard with the many different classes of panels that are needed for this station should contain either several blank panels at different points or gaps between panels. In the latter case the oil cells behind the boards should be built of suitable brick and with sufficient care to give a finished appearance. In order that these blank panels or gaps may be utilized for extensions of any kind, all panels in the switchboard should, if possible, be of the same width. That part of the lean-to or electrical annex immediately over the oil switch cells is in this station carried up to a somewhat greater height than the rest of the annex, in order to form a wire tower containing lightning arresters, wire outlets, etc. Each outgoing high-tension line is fitted with its own independent lightning arresters. No windows should be located in the back wall of the wire tower.

A section of the basement under the transformers is walled off in this station to serve as a blast chamber, this chamber having full basement depth, and therefore becoming an ideal place for the execution of the large amount of wiring which must be done in it. The blast-chamber wall serves in part as a foundation for the converters, the weight of which is supported on two walls. The floor may be left open under the converter frames as described above for the same machines in sub-stations. In this case the basement space between the two walls forming converter foundations may well be shut off by a door from the rest of the basement in order to keep steam, ashes and coal dust from floating up through the converters.

### WIRING OF GENERATING STATIONS.

The same remarks apply to the wiring of the generating stations as are given above for the sub-stations. In addition, the writer prefers to see all exciter wiring carried in iron-armored conduits, on account of the importance of these conductors to the station operation, and the possibility of injuring them mechanically when working on steam pipes or other heavy parts in basement. All field wires and other small conductors of vital importance may well be similarly protected. The precautions considered wise in the wiring of high-class office buildings are certainly none too stringent for power plants, shut downs of which entail large losses.

### GENERATING STATIONS WITH STEP-UP TRANSFORMERS.

For extra high voltage transmission, over 15,000 volts, the generators are preferably wound for a comparatively low voltage, such as 2300 volts, the line pressure being derived from step-up transformers. An admirably arranged station of this kind is that illustrated in plan in Fig. 12 and in partial section in Fig. 15. This station is that now under construction by the Aurora, Elgin & Chicago Railway Company at Batavia, Ill., the designs having been made by the Cleveland Construction Company, through whose courtesy the accompanying plans are made public.

This station is built to contain four 1500-kw, 2300-volt, 25-cycle generators driven by horizontal cross-compound engines, the design contemplating the eventual extension of this station to twice this capacity. All auxiliaries of this station are motor driven, the pumps, condensers, etc., being located in engine-room basement in a row along boiler room wall. Main engine room floor is discontinued over these pumps as the plan indicates. The opposite side of the engine room outside of crane-supporting columns is devoted exclusively to electrical apparatus, with the exception of some spaces which are not needed for the latter and are used for offices, repair shop, oil room, etc. A wall in the basement along the face of crane-supporting columns isolates a space about 15 ft. by 180 ft. in size, all of which serves both as a blast chamber for the transformers standing above it and as a bus-bar chamber containing all high-tension wiring. Two large centrifugal steel-plate blowers on the main floor maintain a pressure of about three-fourths ounce per square inch in this blast chamber, the air being drawn from out of doors.

Each generator is provided with an independent group of transformers, which is electrically a unit with the generator, there being

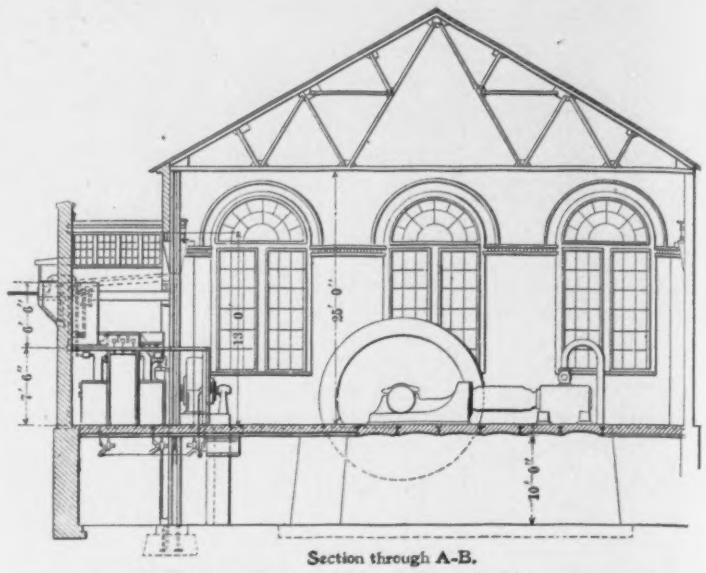



FIG. 14.—VERTICAL SECTION ACROSS ANNEX SHOWN IN FIG. 12.

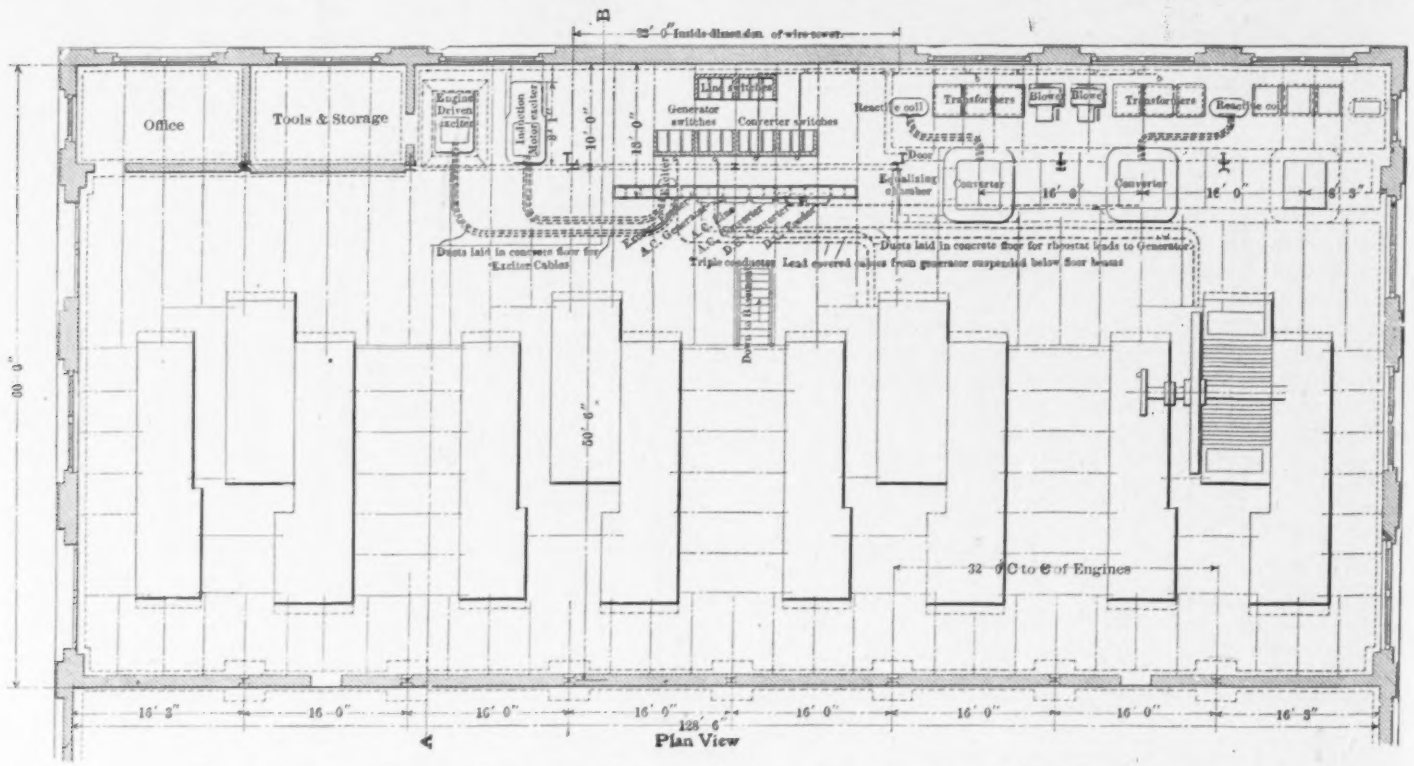



FIG. 13.—PARTIAL PLAN OF GENERATING STATION, SHOWING ARRANGEMENT OF ELECTRICAL APPARATUS.

no low-voltage bus-bars, each generator and its individual group of step-up transformers serving to all intents and purposes as a high-voltage machine. All switching is done in the high-potential 26,000-volt circuits. To each machine requiring a group of transformers there is devoted one bay of the electrical annex, the word "bay" here signifying a space between two adjacent crane columns. It will be noted that the station is laid out for three rotary converters, each of which calls for a group of step-down transformers; thus there will be eventually seven groups of three transformers each in the station. To these seven groups there are assigned seven bays, the two end bays of the nine being devoted to offices. Immediately behind each group of transformers, as seen from the engine-room side, there stands a high-potential motor-driven oil switch.

The 2300-volt leads from the generators pass to the low-tension terminals of the step-up transformers, the high-potential leads of which run directly down into the blast box without issuing from the transformer casing above the main floor. The oil switches are also connected at the bottom, thus keeping all high-potential wiring in the blast chamber or in flues leading up therefrom similar to those described above in connection with a 26,000-volt sub-station of the same road. Thus there is no insulation required on the high-potential wires in the generating station, the bus-wires and leads being enclosed and surrounded by fireproof non-conducting compartments of brick and concrete, thus removing all probability of accidental short-circuit or personal contact.

This station exemplifies a general principle in arrangement which can be carried out with electrically operated switches, and which, if followed, adds greatly to the ease of working out satisfactory details. This principle is that the transmission of all powers, either steam or electrical, should be carried in as direct a line as possible across the station, any longitudinal mains running lengthwise of the station being simply equalizers or distributers, such, for instance, as steam and exhaust headers, electrical bus-bars, etc. The arrangement of the generating units in a single row, with generator switches, so far as possible, mounted at some distance from each other and located immediately opposite their respective generators, the bus-bars being extended the length of the station in order to tie all switches together, makes undoubtedly the best design of stations of large power. Such is the general plan of the electrical arrangement of the main power station of the Manhattan Elevated Railway Company in New York City, this principle being of great value in this instance in preventing a general congestion of many conductors of great power in one small part of the station.

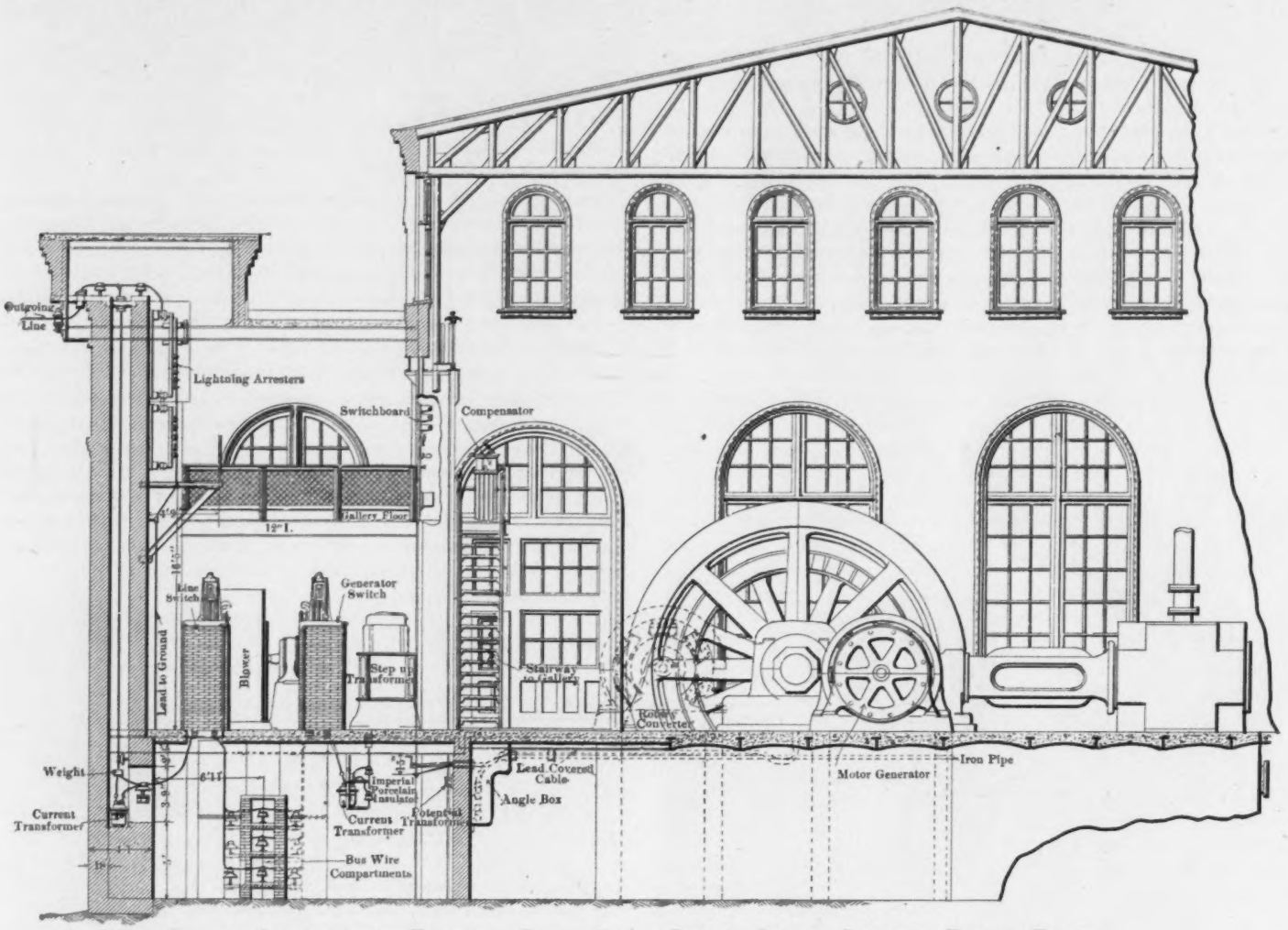



Fig. 15.—Section Across Electrical Side of Engine Room of Station Shown in Plan in Fig. 12.

## Elements of Illumination—XXXII.

By Dr. Louis Bell.

Aside from the sight box the essential parts of a photometer are a long, graduated bar along which the sight box can be slid, suitable supports for the lights to be compared so that they may always be in their proper relation to the graduated bar, and the screens already referred to for cutting off stray light. The elementary arrangement of a Bunsen photometer, except for the screens, is very well shown by Fig. 1. The two lights are supported at known equal distances from the ends of the graduation and the sight box is then slid along the bench until the grease spot shows a balance between the illumination from the two sides. Then the intensities of the two lights are inversely as the squares of their respective distances from the grease spot.

This relation assumes that the lights illuminate their respective sides of the Bunsen screen strictly according to the law of least squares uncomplicated by any sensible regular or diffused reflection. Right here is where the trouble begins. No one who has not tried it realizes the difficulty of eliminating reflection. There must be no reflecting surfaces about the photometer and it must be in a darkened room with non-reflecting walls, as far as it is possible to obtain them. Several coats of dead black paint prepared from lampblack with just enough thin shellac to serve as a medium answers the purpose fairly well. The photometer bench should allow not less than 6 ft. between the lights, and better 8 or 10. A room about 12 ft. by 6 ft. is a con-

venient size for photometric work and the higher the better, as a low room is apt to become unpleasantly hot after working in it awhile. The bench should run along one side and all the apparatus should be stowed on a shelf under it within easy reach of the hand for the room should be kept as dark as possible to avoid loss of sensitiveness in the eye.

A couple of small heavily shaded incandescent lamps with switches in easy reach form a convenient means for securing what little light is needed, and it is convenient also to have a tiny miniature lamp with a ground bulb and an opaque screen to keep the light from the observer carried on the sight box just above the pointer. This lamp should be furnished with a mere contact key on the carriage of the sight box so that it can be momentarily lighted to read the graduated scale.

For very precise work the Lummer-Brodhun photometric screen is sometimes used. This need not be described here further than to say

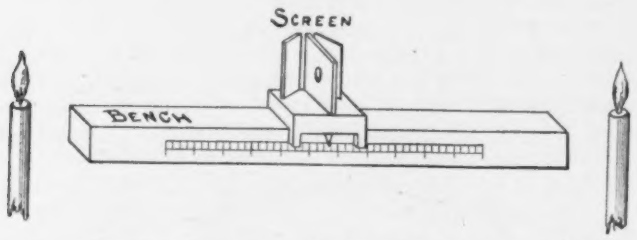



FIG. 1.—ELEMENTARY ARRANGEMENT OF BUNSEN PHOTOMETER.

that it is a somewhat complicated but beautifully effective device, rather costly and not as widely used in this country as the simpler Bunsen screen. Opinions differ widely as to the real relative merits of these two devices. In the writer's judgment, the Lumner-Brodhun screen when carefully used for the comparison of lights not differing greatly in intensity or color, permits a somewhat closer balance than the Bunsen screen, but under ordinary conditions the latter is nearly or quite as effective and much easier to use.

The general structure of the photometric apparatus should be rigid and substantial. All the working parts should more easily and smoothly, and all the accessories should be as accessible as possible so as not to detract the attention of the observer from the work in hand.

Attempts are sometimes made to reduce the photometer to a compact, portable form, that can be easily set up for testing in any convenient location. As a rule, such portable photometers are rather unreliable. It is hard enough to do precise photometric work under the most favorable conditions, and in portable apparatus the tendency is to sacrifice too much to compactness. For certain classes of work in which high precision is not necessary the portable photometers are convenient, but they are not to be advised for general purposes. Many commercial photometers, both permanent and portable, are provided with scales so graduated as to read candle-power, directly assuming a certain fixed distance between the lights under comparison and a fixed intensity of the standard. It is, of course, much easier to make photometric tests rapidly with such a scale, but it should be used with extreme caution, and as an auxiliary. When once correctly adjusted it is most convenient, but it should be assumed to be mal-adjusted at the start, and its correctness carefully verified before it is regularly used. The same precaution should be taken with any other apparatus graduated for convenience in arbitrary units.

The holders for the lights to be compared should be easily adjustable so as to enable the operator to bring the luminous areas into exactly the right position with respect to the graduated scale. When incandescent lamps are under test it is convenient to mount the lamp to be tested upon a rotating spindle so that by revolving it at the rate of three or four turns a second the mean horizontal candle-power may be obtained at a single reading. Other sources of light are generally measured also horizontally, but in a single conventional azimuth, and it is a question whether in the long run it is not better to measure incandescent lamps in a similar fashion. If any mean value of the luminous energy is to be considered important, it is the mean spherical rather than the mean horizontal, and it has already been explained how by changing the shape of the lamp filament the distribution may be widely altered without being changed in amount so that spherical candle-power is really the significant thing.

Rotators for incandescent lamps are, however, convenient, and particularly so if arranged so as to allow the axis of rotation to be tilted at any required angle. But they require watching if accurate work is desired, since it is very difficult to avoid small and variable losses in voltage at the lamp due to varying resistance at the brushes which convey the current from the fixed to the rotating part of the device. Mercury-cup contacts are somewhat more reliable, but do not lend themselves readily to tilting the axis of rotation.

Fig. 2 shows an excellent typical form of photometer intended primarily for testing incandescent lamps, but readily adaptable to more general purposes. It consists of a pair of little standards supported by cast iron columns and supporting the lights and their accessories and the pair of steel shafts extending between them and bearing the photometer carriage. The forward bar carries the graduation. On the left is the carriage for the standard lamp screwed in front and curtained behind, and on the right is the rotator, similarly screwed for the lamp to be tested. A pair of sliding screens help to cut off extraneous light from the sight box, and each lamp is provided with a rheostat for the exact adjustment of its voltage, and with the necessary electrical connections.

In setting up such a photometer even in a room painted dead black the screens supplied should be supplemented by other and larger ones placed nearer the sight box to cut off indirect illumination. It would also be advisable to place a long shelf from standard to standard under the photometer bar. This should be painted dead black and used to carry instruments and accessories ready to the observer's hand. In this instance the distance between lights is made either two or three meters, the longer one being preferable for measurements of precision.

The sight box is mounted on trunnions so as to be reversible as a whole with respect to the ends of the bar. In thus reversing the errors due to difference in the reflecting mirrors or in the sides of the Bunsen screen proper, as well as the personal errors between the observer's two eyes are eliminated from the result. There is, however, a personal error as between different observers that is not easy to be rid of. The idiosyncrasies of the eye in photometric work almost

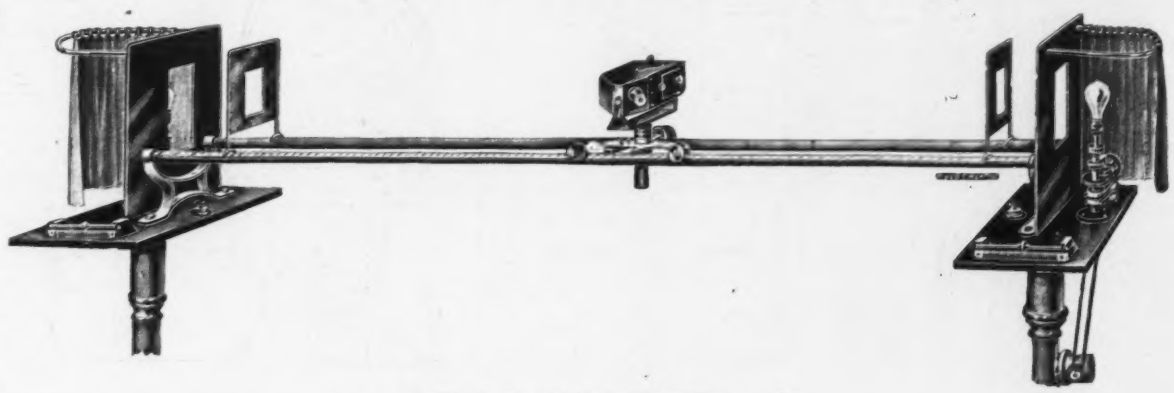


FIG. 2.—STATION PHOTOMETER.

pass understanding. Two observers setting the Bunsen screen alternately on the same lights in quick succession will not infrequently obtain results differing by nearly 10 per cent, each man's readings, however, being closely consistent. The same observer will, as a rule, get consistent results from day to day, but has his own habit of seeing the spot on the screen disappear. Such individual differences are particularly marked when comparing lights differing in color.

In comparing, however, lights of approximately the same intensity and color, as in testing incandescent lamps, there is a convenient way of avoiding most of the errors in photometry, which can hardly be too strongly commended. It is one of the general processes of physical investigation known as the "method of substitution." It consists of comparing the standard, which we will call A, with an in-

termediary standard B, and then leaving everything else unchanged, replacing A by the object to be tested C.

In applying this method to photometry one would proceed as follows: Place the standard lamp on the rotator of Fig. 2, and the intermediary standard in the socket at the other end of the photometer bar, setting the sight box at the midway point. Then vary the intermediary, either by turning it slightly or by shifting the rheostat belonging to it, until an accurate balance is obtained. Then any lamp of equal intensity with the standard on the rotator may replace it without changing the balance. This eliminates all the errors of comparison save two, first that due to possible variation of resistance in the rotator, and, second, that due to a possible variation in the observer's habit of seeing during the progress of subsequent observations.

Most standard lamps are intended to be used in a fixed azimuth and not in rotation, so that the former error may enter unless the rotator is in first-class order. Its existence is a strong argument in favor of measuring lamps in one or more fixed azimuths.

As to the second error, it is seldom of much moment in the case of a practiced observer, but may be detected and approximately ascertained by repeating at the close of the observations the original observation with the fundamental standard, setting in this case the sight box without varying either lamp. If the observer has been uniform in his habit of setting and the resistance in the rotator has not varied materially, the sight box will give balance at the middle point as before.

The possible residual error is that due to the varying resistance of the rotator when at rest from its resistance when in motion. This error may be detected if it exists by measuring the mean horizontal candle-power of a lamp having quite uniform horizontal distribution, first, by rotating, and, second, by averaging the readings taken, say, in six azimuths 60 degs. apart. If the rotator has introduced no error the two values thus obtained should check each other within the ordinary error of observation.

In incandescent lamp testing there are two general ways of arranging the connections. In the first, called the two-circuit method, the working standard is placed on an independent source of energy generally a storage battery, brought to its proper voltage by means of a rheostat in circuit with it and a voltmeter and kept constant during the observations by occasional adjustment of the rheostat if necessary. The lamps being tested are similarly treated. When a storage battery is available the method is a very satisfactory one, the only errors involved being those in the voltmeters, which need to be frequently compared, and very carefully read.

The second or single-circuit method is shown in diagram in Fig. 3. Here the two lamps to be compared are put in multiple off the same set of mains worked at the usual voltage. The standard, *B*, is brought to its proper voltage by means of the rheostat and a voltmeter, and afterwards the voltages at the two lamps vary together if at all. This method of connection is very much more convenient than the two-circuit method, especially in alternating-current stations. It is, moreover, sufficiently precise if carefully applied. A second rheostat is employed for lamp A if the voltage of the supply circuit varies from the rated voltage of *A*. The essential difference between the two methods is that in the two-circuit scheme each lamp is tested at its rated voltage, while in the single-circuit method the two lamps are tested either at their rated voltages or at voltages equally at variance from these ratings. In the latter case there is a chance for error unless equal increments of voltage correspond to equal increments of intensity. In other words, if *A* and *B* are once balanced, will variation in the voltage of supply destroy that balance?

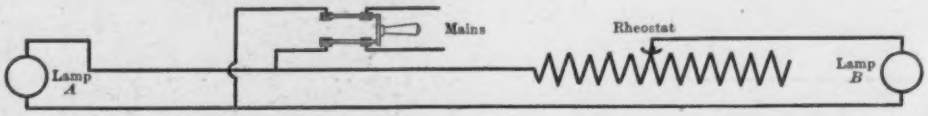



FIG. 3.—CIRCUITS OF THE PHOTOMETER.

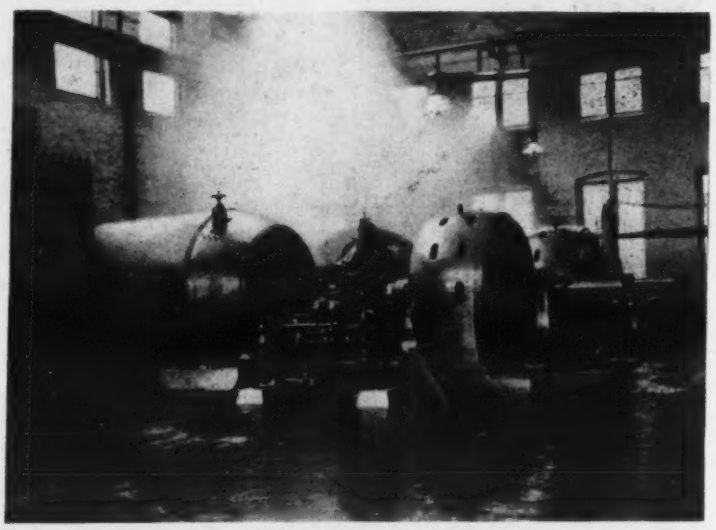
## Governing Waterwheels Under Abnormal Conditions.

By G. U. G. Holman.

At the conclusion of some efficiency tests on our waterwheels at the power house of the Canadian Electric Light Company, Levis, Quebec, we desired to learn how the waterwheel governors operating the waterwheel gates would work upon breaking the machine circuit at full load of the generators. This meant the sudden removal of 1000 horse-power. The result was startling, and for the moment appeared disastrous, for one side of the bonnet of the 30-inch gate valve in the main exciter pipe blew out. This valve was right at the connection of the exciter pipe to the main pipe flume, which is 8 ft. 3 inches in diameter. The head at this point of connection is about 97 ft.

The governors worked very nicely, perfectly controlling the McCormick turbines, the normal speed of which is 400 revolutions. The switchboard attendant had presence of mind sufficient to pull the exciter switch and kill the machine, for at the moment it looked as though everything would be deluged with water and spray. The accompanying photograph, which fortunately one of the gentlemen present was ready and able to take, shows how the water shot up into the roof of the power house. In many ways we were extremely fortunate, the break being just within the power house wall, the blown out side of the bonnet being about 8 inches from the power house wall. The impact of the water being upwards (the bonnet being vertical), the water fortunately maintaining a vertical stream, the generators, exciters and switchboard received no water and but little spray. There was a party of 15 gentlemen present, which naturally was an encouragement to the workmen, several of whom ran immediately to the head gate and closed it after a few minutes. A short circuit at ⅞ gate had occurred but a few days previously, and was likely to occur at any time in the future, so that it was well that this weak point in our system developed itself at such an opportune time.

A temporary repair was effected by clamping the broken-out bonnet side partly in place by means of 2-inch oak planks placed at each side of the bonnet, with bolts run through them round the edge of the bonnet. Of course, a great deal of water squirted through the bad joint, and this water was forced to drop into the tail race by keeping canvas over the valve. In this way we were able to run our exciters until 3 o'clock next morning, when the water was emptied, the broken bonnet taken off, the gate removed, and on the bonnet flange of the valve a 3-inch oak plank was bolted with a thick gasket. In this way the run was continued until noon, at which time a permanent repair was effected by replacing the plank with a ½-inch boiler plate, which a machine shop nine miles away made for us on record time.



EFFECT OF SUDDENLY RELEASING WHEEL UNDER FULL GENERATOR LOAD.

We could discover no flaw in the bonnet of this valve, and the conclusion was forced upon us that it had not originally been built with a view to the service to which it was put. I might add, that the governors are Lombard.

# The Zossen Polyphase Railway Installation for Experimental Trials with Speeds Up to 125 Miles an Hour.—IV.

By Walter Reichel.

*(Chief Engineer Siemens & Halske Company.)*

### THE TRANSFORMER.

THE only available space for the location of the transformers was beneath the car floor. It was necessary to place the three coils of the three-phase transformers side by side and have their long axis correspond with that of the car itself. In this way it was possible to place pipes within the cores through which cool air would circulate.

The iron cores formed three rectangular boxes between which there were formed two spaces, each 30 mm. (1.17 inches) wide, and 205 mm. (8 inches) high. The boxes are connected by heavy bolts, and they are separated by tubes slipped over the bolts. This is shown in Fig. 22. The iron cores were placed vertically so as to gain strength and avoid any bending action due to the jolts which would result during travel. The yoke is divided into two parts, and this makes the total height of the core at the ends of transformers no greater than the total height measured over the winding. The latter consists of the secondary winding, which is insulated from the core by a layer of mica and the primary winding which is separated into several spools placed above the secondary winding.

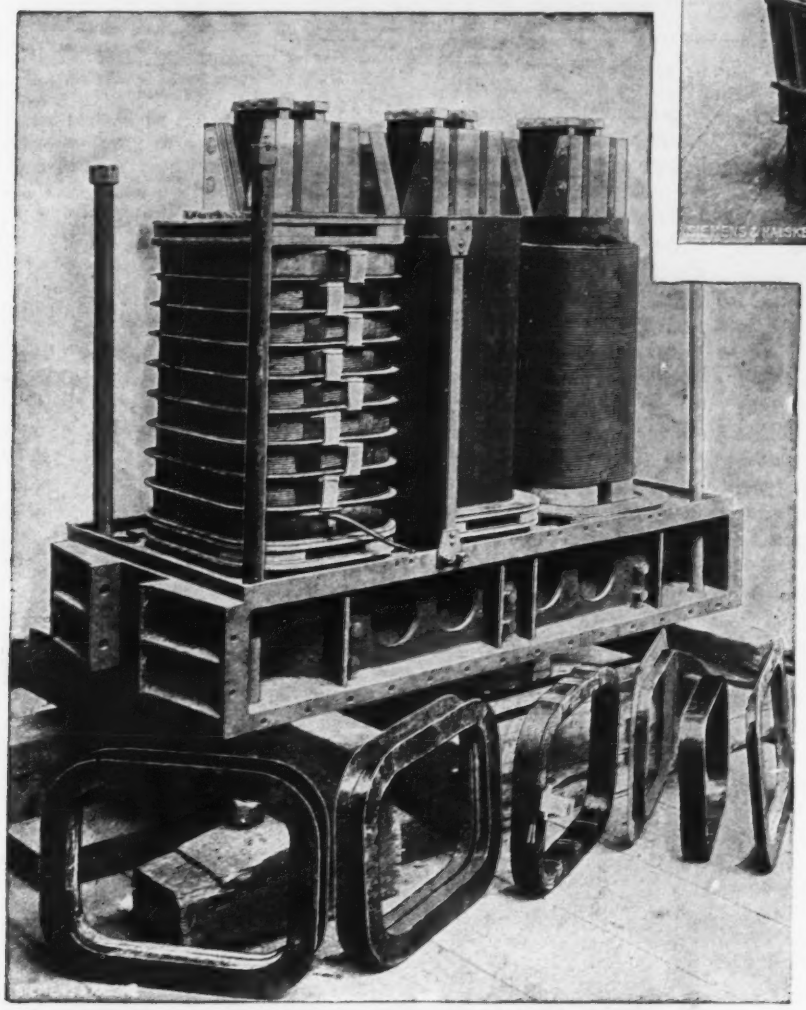


FIG. 22.—LARGE TRANSFORMER DURING CONSTRUCTION.

The two sets of windings are separated from each other by heavy layers of mica. So that the high-tension coils of the three sets do not accidentally make connection with each other they are separated by heavy walls of insulating material. The leads emerge from the coils at their ends. The coils and cores are held together by cast steel plates, into which the yokes are also built. These end plates are connected by four heavy bolts and two U-beams which serve also as a support for the transformers. This is shown in Fig. 23. Here are also shown the openings for admitting the air for cooling purposes, the canals passing from one end plate to the other. The rectangular opening at the top contains the high-tension cables which are led from here to the cableway. The opening is closed by a rubber ring. At the bottom the low-pressure wires emerge.

The transformers are fastened to two extra heavy cross-beams by four heavy angle irons in such a way that by loosening a few bolts they can be quickly removed from the car body.

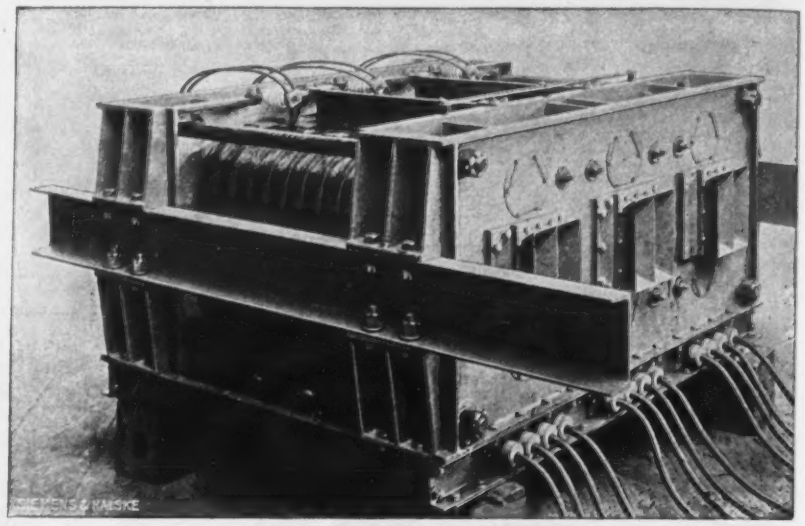


FIG. 23.—LARGE TRANSFORMER COMPLETE.

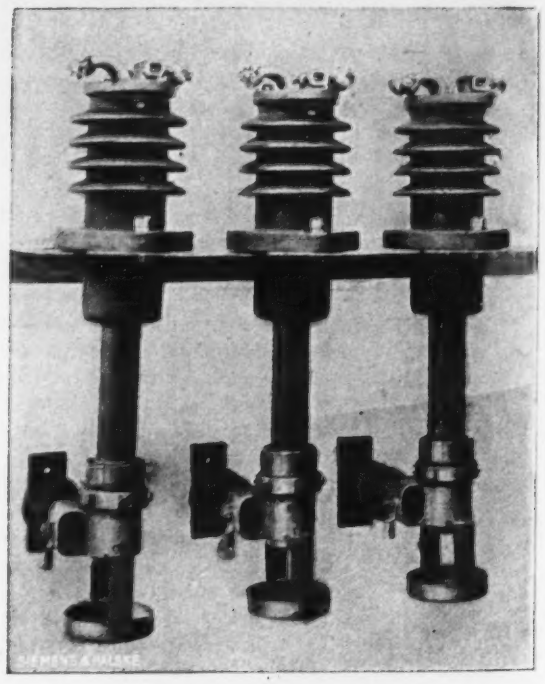


FIG. 24.—MOUNTED HIGH-TENSION FUSES.

This in turn is fastened to a hard-rubber post, horizontally supported, and this carries a small pan for the purpose of catching any metallic particles which may fly off. The entire device can easily be removed from the car. Similarly to this, only with smaller wires and contacts, the high-tension fuse devices for the small air pump transformers are built.

### HIGH-TENSION FUSES.

The three loose ends of the large transformers pass through the cableway on hard-rubber supports. Like the mean pressure fuses they are of the enclosed fuse type, and consist of four tubes containing the fuse wires, which are surrounded by a larger tube of mica.

This tube is fastened to a metallic cover at the top which is provided with flanges to which four bent tubes are fastened, which serve to carry away the vapors which are generated. (To these tubes the fuse wires are connected.)

The cover rests on a peculiarly formed insulator on the roof of the car, which is also used for the wires of the high-tension switch and the fuses for the small transformer.

This insulator consists of a hollow metallic cylinder surrounded by a tube of hard rubber, and around the outside are a number of projections which act as drips for the water. This is clearly shown in Fig. 24. At the lower end of the mica tube is a contact ring which is slipped over a permanent contact piece.

## The Street Railway Convention Automobile Ride.

On Friday, Oct. 11, an automobile trip was provided for the ladies of the convention through the co-operation of Mr. Henry Sanderson, president of the New York Vehicle & Transportation Company, and member of the entertainment committee.

When plans were made for this novel excursion it seemed likely that not more than 100 ladies would participate, but when the start was made from Madison Square Garden at 11.30 a. m. it proved that such an estimate and provision were alike inadequate. It had been intended at first to furnish accommodation for as many male delegates as possible, but it became necessary to exclude these altogether, and when at last the cavalcade was started, consisting of about 120 vehicles, and inclusive of stages, wagonettes, park busses, hansoms, Victorias and runabouts, no fewer than 360 ladies had been accommodated. It is true that quite a litle crowding was necessary to make room for so many, but whatever crowding was experienced was endured quite good-naturedly.

The automobiles made a sensation as they proceeded through the upper part of the city. Proceeding at an easy pace they went up Fifth Avenue to Central Park and then up the Eastern Driveway to 110th Street. They then crossed over to Riverside Drive and stopped at Claremont. There the famous restaurant was practically turned over to the party, and an elaborate luncheon was furnished to the ladies and to some 40 or 50 gentlemen who had proceeded to the same point by other means of locomotion. The entertainment committee was represented by Messrs. Sanderson, Brady, Cook, Meneely, Wakeman, Martin, Mullin and other members, all of whom were actively employed for an hour or two in attending to the comfort of the ladies in their charge.

After the luncheon to the ladies, and while the committee itself snatched a hasty repast, the party as a whole visited Grant's tomb in the vicinity, or strolled about the plateau around the restaurant looking down upon the new Lafayette Avenue viaduct, the broad sweep of the Hudson, the distant Jersey shore and the misty approaches to the Tappen Zee to the north. About 3 p. m. the party returned to the vehicles, which had been waiting on the drives around Claremont, and proceeded back to the Garden. The trip was of a most joyful nature, the day being bright and the weather balmy and no contretemps of any kind occurring to mar the enjoyment of the occasion.

Mr. Sanderson and his associates were not only voted hearty thanks, but all who participated are entitled to great credit for the smoothness and success with which the thing was handled.

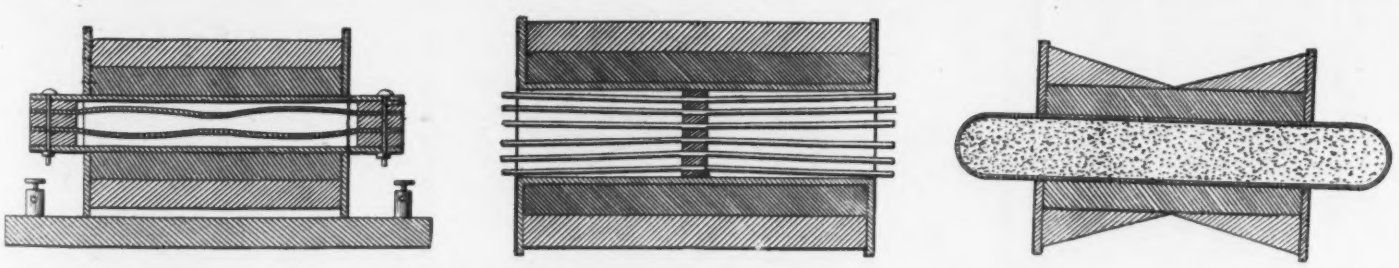
If the rush for seats in the automobiles is any indication of the feelings of the street railway men toward the new means of locomotion, it might well be inferred that they view the coming of the electric automobile with pleasure, regarding it as a valuable adjunct in the near future to existing systems of traction.

Street Railway Convention Automobile Ride—120 Electric Vehicles in Line.

## New Telephone Patents.

The telephonic art contributes no less than 15 patents to the total issue of the Patent Office for October 8. Switchboard systems, as usual, are in the majority, and among these are several belated patents on magneto apparatus for which applications were filed between 1890 and 1892.

Taking telephonic apparatus first, a patent is granted to Hans Liebreich, of Detroit, on a telephone transformer (Fig. 1), provided with a laminated core, the leaves of which are capable of vibration within the coil. The inventor claims that the movements of the plates or leaves of the core will produce induced currents in the secondary coils of very high tension. A second patent on the same invention covers an induction coil or transformer (Fig. 2) with laminated core capable of movement in the leaves or plates with the leaves or plates fixed at the center insead of at the ends. A third patent covers an induction coil or transformer (Fig. 3), of which the core is composed of an iron case filled with iron in a finely divided condition. The inventor says: While very fine iron-dust is found to be sufficient for this purpose, I preferably form the core-filling of a series of short sections of iron wire, the interstices between the same being filled with fine iron dust and the whole mass being compressed under hydraulic pressure to form a solid mass.



Figs. 1, 2 and 3.—Telephone Induction Coils, or Transformers.

William E. McCormick, of Chicago, is the inventor of a switchboard system of which the chief feature is a single clearing out signal, which is operated only when the receivers of both stations are replaced on their switch hooks. In the usual common battery board a supervisory signal is provided for each cord and the operator disconnects only when she gets both lights.

In Mr. McCormick's invention, referring to Fig. 4, the clearing-

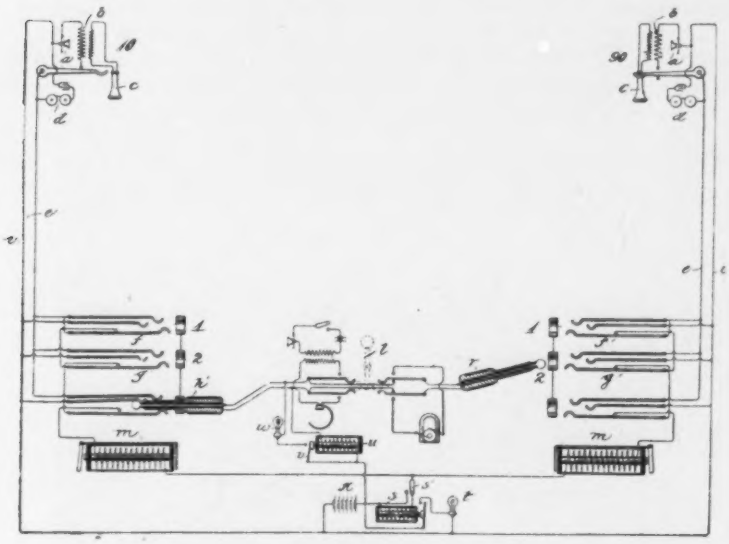


FIG. 4.—TELEPHONE SWITCHBOARD SYSTEM.

out relay *u* is preferably supplied with current from the common battery *K*, the continuity of the circuit including this relay being controlled by the telephone switch hooks at the subscribers' stations and the plugs inserted within the line jacks, this relay being preferably included in bridge between the sides of the telephonic circuit. One terminal of the relay is connected preferably with one of the cord strands of the cord circuit, in this instance the sleeve strand, and thereby with one side of the telephone line, while the other is preferably connected permanently with the remaining side of the telephone line through the common battery. The relay *u* is provided with a contact arm *v*, which is also connected with the common battery.

The contact arm *v* is adapted when released upon de-energization of the relay *u* to engage a contact terminal connected with the signaling lamp *w*, this signaling lamp thereupon being included in a local circuit whose continuity is jointly controlled by the arm *v* and the answering plug with its engaging jack, and also in a second local circuit whose continuity is controlled by the arm *v* and the connecting plug with its engaging jack—that is, the lamp in this instance is common to two local circuits. Two local circuits are thus provided which are independent of the telephone lines, each adapted to include the clearing-out lamp *w*, these circuits being independent of the telephone lines in so far as it is impossible to open and close the same by means of the telephone switch hooks of the connected subscribers' stations.

The clearing-out signal, it is obvious, is not operated until both receivers are replaced on their switch hooks and is not extinguished until both plugs have been withdrawn from the jacks. This system also includes a supervisory signal (shown at *t* in the diagram with its relay *s*), which may be used either as such or as a calling signal for a number of subscribers' lines associated together, thus serving the purpose of a night signal.

A circuit protector of ingenious form is the invention of Alfred Stromberg, of Chicago. Referring to Fig. 5, *p* is a carbon block across which is stretched the fuse *h*, held in place by the binding posts *g g* and separated from the block *p* by the two insulating strips *q*, *q*; a hooked spring *k* engages in the fuse and holds it taut over the insulating plates and in close proximity to the carbon block, also serving to close an alarm circuit when released by the rupture of the fuse.

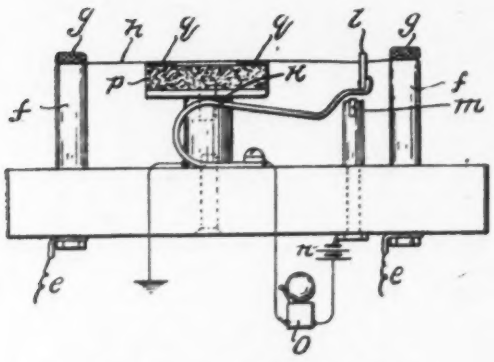


FIG. 5.—TELEPHONE CIRCUIT PROTECTOR.

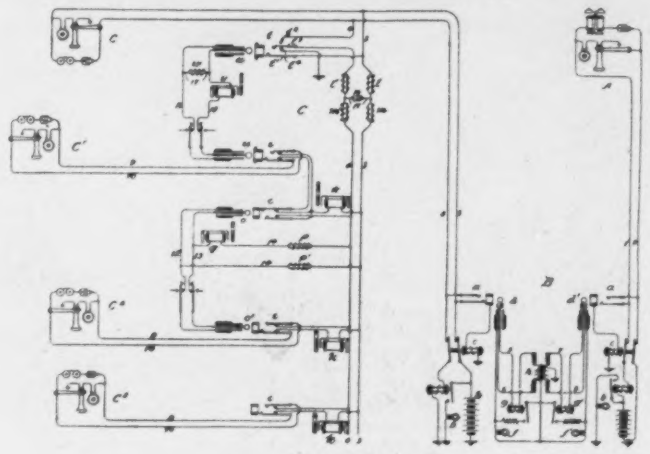


FIG. 6.—BRANCH EXCHANGE SYSTEM.

A telephone exchange system invented by Charles E. Scribner and James L. McQuarrie, of Chicago, is a detailed application of the invention chronicled last week, whereby through an arrangement of impedance coils and condensers, current is supplied from a common battery exchange to extension lines so as to enable communication to be held between the extension lines without interfering with the main line using the same source of current.

Fig. 6 illustrates the system applied to a branch exchange connected to a regular relay central office. *C* is the main station of the branch exchange, and $C^1$, $C^2$, $C^3$ extensions, $C^1$ being arranged so that it can also communicate over the main line, $C^2$ and $C^3$ being able to communicate only with each other or with $C^1$. To enable $C^1$ to connect with the main line, special cut-out jacks, shown at $i^1$ and *t*, and special connecting plugs *u* and $u^1$ are required. These are made of different size from the other equipment of the branch switchboard so that they may be distinguished readily.

## Electro-Chemical Patents of the Week.

The U. S. patent issues of Oct. 8 are of unusual interest from an electro-chemical point of view, and strikingly illustrate the wide range of activity in this art. A brief summary of the principal patents is given on next page, and elsewhere a separate notice appears of two patents on the Edison storage battery, now attracting much attention.

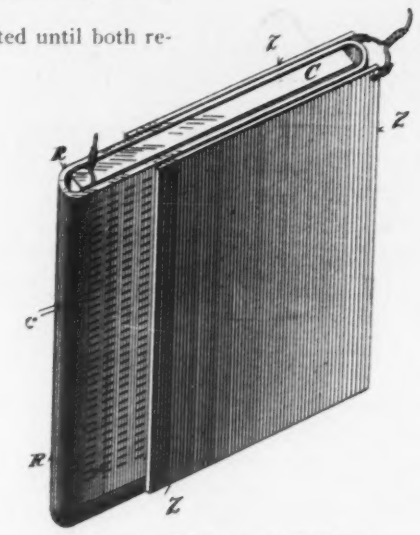


FIG. 1.—POROUS DIAPHRAGM.

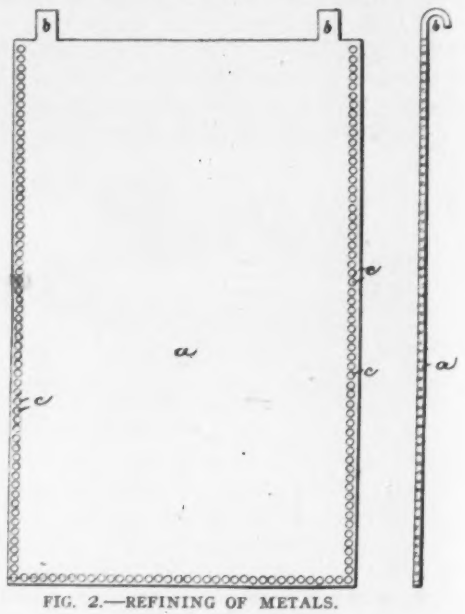


FIG. 2.—REFINING OF METALS.

POROUS DIAPHRAGMS.

Adolph Wunsche, of Charlottenburg, Germany, prepares asbestos for use as electrolytic diaphragms by a method which is of interest because of its analogy to the felting of animal fibers. The moist asbestos is molded by pressure into the form desired, and then subjected to a reagent which attacks the surface of the fiber itself, and under the action of which the felting takes place. Such a reagent is silicon fluoride, either in gaseous state or in alcoholic solution, and the product of its attack upon the fiber is an acid magnesium silicate which binds the roughened contacting surfaces into a firm board capable of withstanding the action of water and of solutions which are neutral or nearly so. The patent is assigned to the Siemens & Halske Company, of Berlin.

A novel battery cup, patented to Stephen de Ayola, of New York, is formed from a pouch of rubber slitted or punctured, the size of the perforations being so related to the thickness of the walls that in the normal position of the sack the elasticity of the rubber nearly or quite closes them. When, however, the walls are at all distended—and this may be effected by any desired mechanical means—passages are opened for the electrolyte and the battery becomes operative. The size of the openings, and hence the resistance of the diaphragm, is thus capable of minute regulation, and the anode and cathode electrolytes may be completely separated when the battery is not in use. The new cup is very light, and, of course, practically unbreakable; whether it constitutes an efficient low-resistance separator does not appear from data given. This device is illustrated in Fig. 1, in which the diaphragm, *R*, slitted as at *c*, is shown in position as a separator between the usual zinc and carbon plates, *Z*, *C*, of a battery. The bag may conveniently be attached to the cover of the cell, when the horizontal slits is opened by slightly raising it.

BLEACHING APPARATUS.

The apparatus patented to Frank J. Briggs, of Everett, Mass., belongs to the class of devices in which sodium chloride is electrolyzed in a cell divided into anode and cathode compartments by a porous partition, the fabric or other material to be treated being placed in the anode chamber and agitated in contact with the nascent products of the electrolysis. The specification and claims are confined to details of construction which serve to protect, more fully than heretofore, the apparatus itself from the liberated chlorine and caustic.

REFINING METALS.

Two improvements in this line emanate from Perth Amboy, N. J. William A. McCoy proposes to facilitate the removal of electrodeposited copper sheets from the usual metal cathode plates by providing these with an insulating inlaid margin, as a substitute for the cumbersome wooden frames heretofore used. The insulation, which is preferably of a bituminous nature, is either inserted in a series of closely spaced marginal perforations in the plate or simply packed into marginal grooves. Fig. 2 shows in front and side elevation a plate prepared by the former method, the sheet *a*, with the usual supporting lugs *b*, being perforated as indicated at *c*. These holes define the limits of the desired sheet, the outer strips being treated as scrap. The use of scratch-grooves, without insulation, for the same purpose, has recently been described in these columns.

Elliott and Kishner provide each refining tank with a series of lateral spacing pins, corresponding to the intervals between the plates, so that these may be securely held in proper relation and at the same time guarded against accidental short-circuiting from buckling or other cause. The pins are of hardwood, and in their operative position extend between the plates, but are so mounted on horizontal rotatable shafts which traverse the tank from end to end, that by a single movement of a hand-lever they may be raised to a position parallel to the sides of the tank. With the pins thus placed, the tank may be charged, emptied or cleaned without interference.

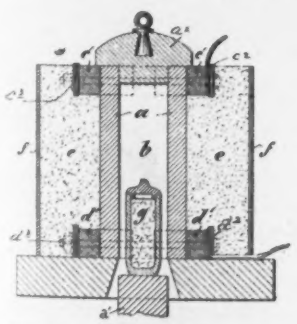


FIG. 3.—ELECTRIC FURNACE.

ELECTRIC FURNACES.

Drs. Nernst and Glaser describe an electric furnace based upon the "Nernst principle," and illustrated herewith (Fig. 3). The resistance heater or glower *a* is a cylinder of dry electrolytes, preferably formed from a mixture of magnesia with a small percentage of calcium carbonate, alumina, silica or kaolin. The cylinder may be covered as at $a^2$, and jacketed by loose oxides *e* held in position by an envelope *f*, to conserve the heat. The material to be heated is placed within the cylinder, and may be enclosed in a crucible mounted on a movable base, as shown at $a^1$, *g*. The distinctive feature of the furnace is the manner in which electrical connection is made to the ends of the resistance. For this purpose use is made of an oxide like that of iron, which possesses considerable conductivity at normal temperatures, this oxide, shown at $c^1$, $d^1$, being packed around the ends of the cylinder and held in close contact therewith by plates of iron, $c^3$, $d^3$, secured by bolts $c^3$, $d^3$. When the furnace charge is of such character that danger might arise of fluxing the dry electrolyte, and especially when the crucible is dispensed with, the cylinder is protected by an interior sleeve of pure magnesia, preferably coated with graphite to give it some initial conductivity. This furnace in either of its forms may be excited by a carbon resistance rod inserted temporarily through the bore, or even by a gas flame.

Hudson Maxim has patented a method of making calcium carbide, illustrating and describing an electric furnace for carrying it into effect. The furnace is a rotary structure, vastly complicated, and presenting no clear advantages and one obvious disadvantage as compared with forms in present use; this defect being the necessity for heating a large body of molten carbide to the temperature of complete fluidity. The furnace may be dismissed as without practical interest, but the claim based upon its operation is so broad as to demand attention. The words are: "The method of making calcium carbide, consisting in maintaining a carbide-conductor incandescent by means of an electric current, subjecting carbide-forming materials to the heat thereby engendered, thus converting said materials into calcium carbide, maintaining the cross-sectional area of the carbide-conductor approximately constant by removing the calcium carbide from the furnace as formed, and supplying fresh materials to the heating field."

In explanation of the grant of a claim of this breadth at this date, it appears that the application has been pending before the Patent Office since June, 1895, a period when the carbide art was exceedingly meagre.

## The Edison Storage Battery.

Among the patents of last week are two on modifications of the new Edison storage battery. In the form of cell patented some months ago, it will be recalled, the oxidizable element and the depolarizer consisted of finely divided iron and an oxide of nickel (or cobalt),

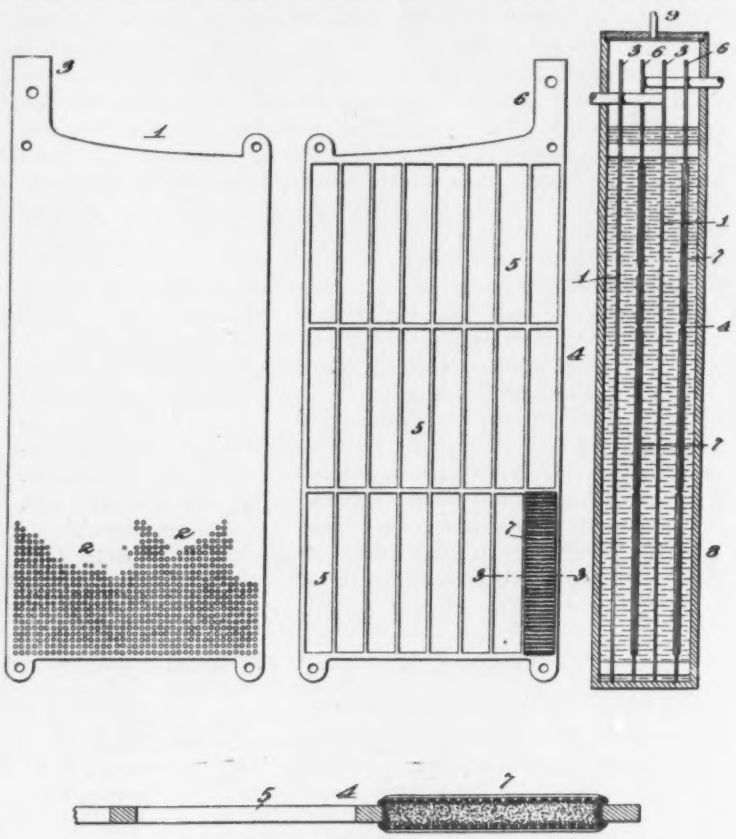


FIG. I.—EDISON STORAGE BATTERY.

respectively, both elements being preferably mixed with flake graphite to increase their permeability to the alkali hydroxide solution. In the forms now disclosed the oxidizable metal is zinc, the

depolarizer an oxide either of copper or of nickel, and the electrolyte an alkali metal zincate in solution. These combinations are not unfamiliar, but the cells have not, hitherto, been considered as reversible, and the conditions under which they are rendered so are in the highest degree interesting.

If it be attempted to reverse a cell of the usual zinc—alkali hydroxide—copper oxide type, it will be found that the copper passes in part into solution as the so-called "cuprite," and that the zinc is deposited in the form of a loose sponge. Mr. Edison states that if certain precautions be observed in the preparation of the copper oxide, its tendency to solution in the alkaline electrolyte may be overcome, and he considers an essential feature of this preparation to be an extremely fine sub-division of the copper. To secure this, pure carbonate of copper is reduced by hydrogen at the lowest possible temperature, molded into the desired form, oxidized by heat to the

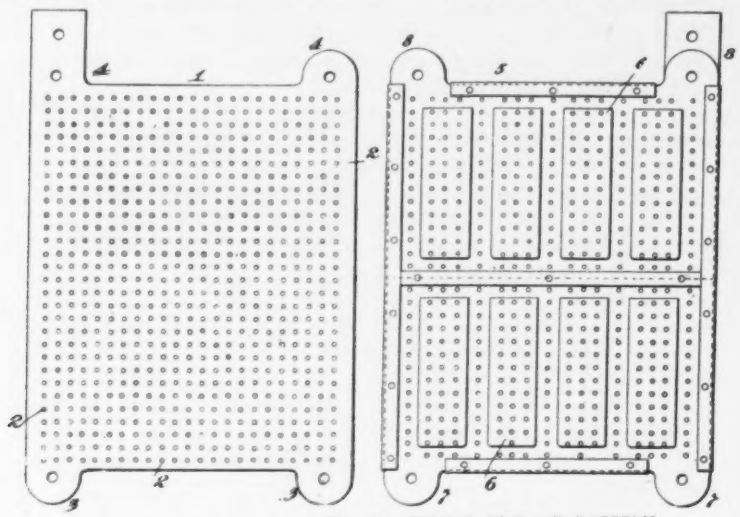


FIG. 2.—EDISON STORAGE BATTERY.

black oxide, CuO, and finally electrolytically reduced to the metallic state. So prepared, it is oxidized in charging the battery to the red oxide $Cu_2O$, but shows no tendency to pass into solution. It is difficult indeed to believe that this remarkable effect is properly attributed to the state of minute sub-division; if so, the fact is unique in chemistry.

The second difficulty—the deposition of spongy zinc—is overcome by the simple expedient of using as a base for the electro-deposit a thin multi-perforated sheet of magnesium. If it be assumed that the tendency of zinc to deposit in sponge form is due to the partial oxidation of the precipitated metal, then it is readily apparent that the nature of the support may exert a controlling influence on the character of the deposit, and that magnesium, being electro-positive to zinc and entirely unattacked by the caustic alkali, can give rise to no local action, and therefore to no oxidation due to this cause. This is the explanation of the inventor. It is not free from chemical difficulties, for other means may be employed to prevent local action, and yet these have not proven efficient in suppressing the formation of sponge; but the essential commercial point—the fact—seems to have been sufficiently establishd by Mr. Edison's experimental work.

In the accompany illustrations, Fig. 2 represents a plan view of the magnesium support on which the zinc is plated during the charging, a similar view of the plate for carrying the negative element, and a vertical section through a cell formed of four elements. In Fig. 1 are represented similar views of another form of cell, showing a plan view of one of the magnesium supports on which the zinc is plated during the charging operation, a similar support for the depolarizing material, a section of the latter on an enlarged scale and a section through a four-element cell.

## Kentucky Telephone Association.

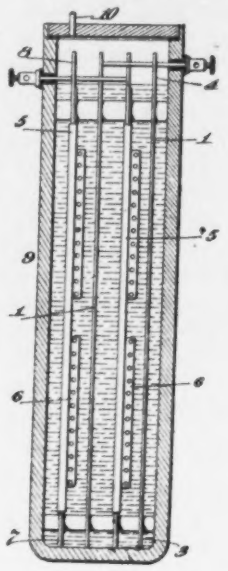
The Kentucky Telephone Association held its annual meeting at Owensboro, Ky., on Oct. 2. The following named officers were elected for the ensuing year: R. V. Bishop, of Cynthiana, was re-elected president; H. K. Cole, local manager of the Harrison Telephone Company, vice-president, and James Maret, of Mt. Vernon, secretary and treasurer. The place of the next weeting was referred to the Executive Committee of the association.

James S. Brailey, Jr., of Louisville, read a paper upon long-distance service and H. K. Cole a paper upon exchange service.

The companies of Louisville, Lexington, Winchester, Mt. Sterling, Maysville, Cynthiana, Versailles, Henderson, Morganfield, Uniontown, Fordsville, Slaughtersville and Nicholasville were represented as were the Bastion, of Lancaster; Rough River, of Hartford; Hancock, of Hawesville, and the Green River, the line between Owensboro and Henderson.

## The American Pacific Cable Question.

According to special dispatches from Washington, of Oct 11, Attorney-General Knox was not ready at the Cabinet meeting to report fully on the proposition of Mr. John W. Mackay and associates to lay a cable across the Pacific from San Francisco to Manila, via Honolulu and Guam. The Attorney-General appears to have proceeded far enough in his investigation to determine what is probably the most important point, and that is that the British cable company now doing business in the Philippines did not secure a guarantee of monopoly for 40 years or any other term by either the general or the specific provisions of the Treaty of Paris. The question as to whether or not the President, under his general executive authority, has the power to grant or withhold the landing privileges sought by the Mackay people has not yet been determined by Mr. Knox. However, in view of the probability that the President will have something to say on the subject of a trans-Pacific cable in his forthcoming message to Congress, and also in view of the fact that Congress may insist upon its exclusive privilege to handle the subject, it is inferred that, regardless of the findings and recommendations of the Attorney-General, no action of any kind will be taken on the Mackay proposition by the President.



The matter of the Spanish concession granted in 1898 to the English company, giving it an exclusive franchise for cable connections in the Philippines, was carefully considered. Attorney-General Knox advised the President that this exclusive franchise would not hold. He cited the recent action by the Transvaal Commission, which held that the concessions granted by the Boer Government in the Transvaal would not be recognized as valid by the British Government.

It is regarded as significant that, coincident with the report of the Attorney-General's opinion ignoring the claim of monopolistic rights made by the cable concern now doing business in the Philippines, comes an apparently well authenticated rumor from this city of great activity on the part of Mr. Mackay and his associates in the trans-Pacific cable enterprise. It is said that they are now about ready to begin actual work on the cable, and that they propose to go ahead just as though no question as to landing privileges had ever been raised. If they do begin the work of construction before Congress meets, and without stipulated encouragement from the executive department of the government, it is not doubted that the subject of a government cable to the Philippines touching at Honolulu and Guam will be agitated in lively fashion in Congress this winter, and that an interesting fight between the forces of the Postal and Western Union Telegraph companies will enliven the early proceedings of the session.

## The Yale Bi-Centennial.

Electric lighting and decorative effects will form a conspicuous feature of the Yale Bi-Centennial to be held next week. Mr. George D. Foote, an electrical engineer of New Haven, has prepared plans for the display, which have been accepted. There will be a liberty pole of electric lights. A big star will surmount the pole. From the pole there will be festoons with tri-colored lights sweeping in curves from 240 to 420 ft. in length, centering in stars of lights at the old elm trees. There will also be festoons of electric lights between the trees themselves. In these decorations it is stated that 4300 lights will be required. The front of the City Hall will be outlined by electric lights.

# CURRENT NEWS AND NOTES.

*PAN-AMERICAN AWARDS.*—A very full list of Pan-American awards appears in a supplement to our present issue. We are glad to call attention to the fact that a gold medal has been given to the McGraw Publishing Company in recognition of the merit of ELECTRICAL WORLD AND ENGINEER and its other technical publications, books, etc.

*THE "KRONPRINZ WILHELM,"* the new steamer of the North German Lloyd, which recently arrived at New York, has a lighting plant of 1900 lamps, supplied from four dynamos. All the clocks are electrically regulated from a master clock in the chart room, and there is a complete telephone exchange system for all departments. She is also provided with a wireless telegraph system.

*ELECTRIC POWER IN BELGIAN COAL MINES.*—The United States Consul at Brussels, Belgium, reports the installation of a large mining electric power plant at Charleroi, for the supply of three mines situated about a mile distant from each other. Electric pumps are located at the bottom of pits about 1600 ft. underground. The current from the central generating station, presumably alternating, is transmitted at high tension, and conducted into the pits by steel-sheathed cables. There will be four electric pumps of 200 horse-power each, and two generating sets of 1200 horse-power each.

*HOLLAND BOATS FOR THE DUTCH.*—A telegram from Greenport, L. I., of Oct. 15, says: "Commissioners appointed by the Government of Holland arrived here last night to investigate the workings of the Holland submarine torpedo boat for the purpose of making a report to the Holland Government as to the advisability of adding one or more to the navy of Holland. The commission consists of Admiral Tadema, chief of staff; Captain Wuntholtz, chief of the Bureau of Torpedoes, and Naval Constructor Rappe. To-day the commission went on board the Holland Torpedo Boat Company's steam yacht "Giralda," and, in company with the firm's officers, spent the time at the proving grounds at New Suffolk, where the company's machine plant is situated. The torpedo boat "Fulton" was inspected as she lay at the wharf, and the principles of the craft were explained. The commissioners returned to Greenport to-night. They will go to New Suffolk again to-morrow. Later they will separately be taken under the surf in the "Fulton."

*THE NEW YORK CENTRAL TUNNEL.*—It is understood that the engineering department of the New York Central will very shortly let contracts for the proposed change in the Park Avenue tunnel. Work will probably be commenced by December 1. It is proposed to experiment on the section from Fifty-sixth to Sixty-sixth streets, or a distance of ten blocks. The cost will be about $250,000, and the work will probably be completed by spring. The work involves tearing down masonry and erecting steel supports and girders. This will allow a freer circulation of air and more light. If this improvement is satisfactory then thirty remaining blocks in the tunnel will likewise be remodeled, but this work will be more arduous and expensive than on the first quarter of the tunnel. About 500 trains pass through the tunnel daily, so progress will be necessarily slow. The entire cost of the completed project will exceed $2,000,000. It will be noted, however, that this does not affect the ultimate solution of all the difficulties by a resort to electricity.

*ALTERNATING-CURRENT SERIES ARC LAMP REGULATION.*—Eight patents were granted Oct. 8 to M. H. Baker on a method for regulating the current in an alternating-arc lamp series circuit. Briefly, the method consists in the introduction into a circuit of a choke coil the winding of which is automatically adjusted with respect to the core. As illustrated, the core is of U-shape, and the coil embraces a greater or less portion of one of the legs of the U. When the circuit is fully loaded but a slight portion of the core is within the coil, while at the minimum load the maximum amount of the core is embraced. The coil is mounted on one end of a lever, and six of the patents are entirely devoted to means whereby a weight in connection with the other end of the lever is made to move in such a path that its effect will oppose and vary with the magnetic pull of the coil in such manner that the value of the current traversing the coil shall be made practically independent of the resistance of the circuit, thus enabling a constant current to be maintained irrespective of the number of lamps in operation in the circuit. The path which the center gravity of the balancing weight should traverse is determined for a given coil experimentally by cutting successively into the lamp circuit in which it is placed one lamp after another until the maximum number is cut in. The patents describe arrangements whereby the center of gravity of the weight shall be made to traverse this path as the lever moves on its pivot. In one case the balancing end of the lever is placed at such an angle with the coil end as to cause the weight to travel in the determined path. In another case this object is effected by suspending the weight at a certain point of a chain, one end of which is secured to the extremity of the balancing lever, and the other end to the fulcrum of the same. In another, the weight is hung from a chain, which seats in a groove in the upper part of the arm, the arm being curved to cause the weight to move in the predetermined path. In still another case the weight is divided into a large number of disks which are so arranged that as the supporting end of the proper lever ascends or descends one or more of the separate portions of the weights are thrown into or out of service by being seated on a support, or one on top of the other. In still another form the coil is immersed in oil and the necessary balance obtained by a float of determined contour. Another method involves the use of a cam or curved surface, along which the weight in the form of a roller moves. The final patent describes the use of a spring for maintaining the necessary balance between the magnetic and opposing forces.

*NERNST LAMP PATENTS.*—Among the patents of last week are seven relating to details of the Nernst lamp, four of which were issued to H. N. Potter, two to M. W. Hanks, and the seventh to F. N. Goddard. One of the Potter patents relates to terminals for electric lamp glowers. The ends of the glowers are painted with a thin coating of platinum arsenite then heated to a temperature sufficient to drive off the arsenite. This leaves a thin film of platinum in intimate contact with the material of the glower. A loop of fine wire is then slipped over the platinum film and covered with a body of pasty material similar in composition to the glower itself. Another patent relates to a form of glower heater support. The support is hollow and tubular in cross section, and is made by mixing about 100 parts of soapstone powder with 15 parts of a binding material, such as dextrine, and 40 parts of water. On the thin walls of this tube the heating wire is wound. The two remaining Potter patents are on heater cut-out devices for automatically interrupting the electric heater circuit when the glower becomes conducting. In one form a carbon filament is used as a spring for moving the contact cut-out terminals into engagement, a thermostatic device acting in opposition to the spring to open the circuit; the whole is enclosed in glass tube, which is either exhausted or contains an inert gas. In another patent having the same object in view springs are dispensed with, a magnetic device being substituted. A small iron ball is confined in a tubular cavity between the two poles of a magnet. The cavity is formed of two sleeves slipping over and secured to the respective pole pieces, there being a space between the free ends of the sleeves. The magnet winding is in circuit with the glowers, and when no current is passing the ball makes connection between the two sleeves, which are in the electric heater surface. When current commences to pass through the glower the ball is attracted by one or the other of the pole ends and held out of contact with the sleeves, thereby interrupting the heater circuit. Both of the Hanks patents relate to details of the glower. One describes a glower, the working portion of which is deeply grooved, thereby affording the largest practical amount of light-emitting surface without a sacrifice of strength in the glower. The other patent relates to means for making electrical connection with the ends of the glowers. Each end of the glower is enlarged by applying to it a mixture of one or more oxides of the rare earths moistened with water and held together by a binder such as dextrine. These beads are then subjected to the action of an oxy-hydrogen flame and thoroughly baked. The leading-in wires are then fused to the beads by means of some conducting alloy, such as copper-platinum. The Goddard patent is also on a form of glower terminal. From one up to several fine wires are wound around a form slightly larger than the end of the glower, and the loose ends twisted tightly around the strand. The end of the glower is then inserted within the wires, following which they are twisted just enough to make them bind upon the glower. A paste of the same or similar material as that of the glower is then applied to the outside of the wires.

*YUKON CABLE RATES REDUCED.*—The Canadian Dominion Government has made a change in the cable rates to the Yukon, which heretofore have been $4 for a minimum of ten words. The future rate is to be 40 cents per word. The press rate, hertofore $3 for 100 words, has been made $1 per 100 words.

*THE BUFFALO AUTOMOBILE TEST.*—After some careful work the committee of the Automobile Club of America, in direct charge of the run, made public its report last week. David Wolfe Bishop, as was expected, won high honors with a clean record of 15 miles an hour for the entire run, the maximum limit. He used his French machine, a 30-hp Panhard, and was the first to finish each day's run. A fraction below him, with a total average of 14.18 miles per hour, comes Elmer Apperson. Five machines finished the trip below the minimum rate, making a total of 42 vehicles from 80 starters that reached Rochester. Remarkably good showing was made by the Packard gasoline vehicles of the Ohio Automobile Company, one of them rating fourth, and four being among the 20 securing first class certificates. Mr. J. W. Packard is the well-known manufacturer of incandescent lamps.

*THE KAISER AND THE CARS.*—A recent special cable dispatch to the *New York Times* says: The differences between Emperor William and the representatives of the city of Berlin have been thrown into the background by the dispute regarding the advisability of permitting tram lines to cross Unter den Linden, Berlin's principal and most beautiful thoroughfare. Most people sympathize with the Kaiser's determination to prevent Unter den Linden being disfigured. The question, however, has now assumed a more serious aspect, since it is learned that certain exalted personages led the Berlin magistrates to believe that the Kaiser approved their scheme, and the municipality bought the tramway systems from Herren Siemens & Halske for 10,000,000 marks ($2,380,000). The incident is regarded as another proof of the lack of regular personal intercourse between Emperor William and his Ministers.

*IMPORTANT INSTITUTE MEETING.*—A very important paper on the general subject of the speed regulation of prime movers, with special reference to the successful operation of alternators in parallel, by Mr. P. O. Keilholtz, of Baltimore, will be read and discussed at the next meeting of the American Institute of Electrical Engineers, to be held at No. 12 West Thirty-first Street, New York City, on Friday, Oct. 25. Short papers on the parallel operation of alternators will also be presented by Messrs. C. P. Steinmetz, W. L. R. Emmet and E. J. Berg. The committee on papers realizing that the problems presented by this question can be better understood, analyzed and solved by intelligent co-operation, or concerted action, between the designers and builders, has invited representatives of the leading electrical steam engine, gas engine and waterwheel manufacturers to take part in the discussion of the subject of the speed regulation in general, and of the control and compensation of variations of angular velocity in particular. All who are interested in the subject are cordially invited to attend.

*THE RAILWAY RETURN CIRCUIT.*—In the discussion of a paper read at the recent Street Railway Convention by Mr. E. J. Connette on the railway return circuit, an abstract of which appeared in our issue of last week, opinion was quite pronounced against an independent metallic return. Mr. Meyers said that his company had considerable trouble with welded bonds after a couple of years of service. Mr. Harrington considered that the placing of return feeders on a road of ordinary size is not warranted, and described a method of bonding which he had employed with much success. This consists in a heavy copper plate 4 by 6 inches, with two grooves in it, bolted to the web of the rail with two 1-inch bolts with an iron plate grooved for two No. 4-0 wires. He believes that auxiliary copper returns are only needed in the vicinity of the power house. Mr. Pastell, of Worcester, Mass., said that he did not see the necessity of supplementary copper wires unless the output rises to 20,000 amperes or above. On his road every sixth or eighth joint is cross-bonded. He agreed with Professor Roberts that it is well to connect around "special work," tops of hills and other places where the conditions are especially severe on bonding. Mr. Uhlenhaut said the question of using auxiliary returns was largely a geographical one, and mentioned one case where it was found desirable.

*LIGHTING THE NEW YORK UNDERGROUND.*—It is said to have been decided that the walls of the New York Underground road shall be painted with some sort of "cold-water paint" tinted in blue or gray, enough to modify it from a dead white. The motormen in the Boston Subway, though they pass underground for only a portion of their trip, complain that the whitewashed walls are hard on their eyes. The rows of incandescent lights, breast high, which run along the sides of many steam railroad tunnels, would in this case, it is held, be inadequate. Supplemented by the glare of a locomotive headlight, they show up the track well enough, but not, it is declared, without it. Arc lights only, and at short intervals at that, will give sufficient illumination, but here again there is a difficulty. The brilliant and concentrated light of an unprotected arc light would half blind the motormen, who have to look straight at it, and, on the other hand, most of the ordinary kinds of shades absorb a large share of the light rays. To diffuse the light without losing it is the problem. Mr. Parsons will learn how every other city has done this before choosing a system for this city. There are systems of reflectors which have merits in this direction. Globes are also made of glass cut inside and outside into facets that deflect the light upward, downward, or sideways, making the illumination as soft as from ground glass and with a loss of only a very small fraction. An experiment has been made with a glass covering, such as that used in sidewalks, but the results were not conclusive. The Nernst lamp also comes in as a new possibility.

# LETTER TO THE EDITORS.

## Some Aspects of Telephony.

*To the Editors of Electrical World and Engineer:*

Sirs.—I have been very much interested in the recent editorials in the ELECTRICAL WORLD AND ENGINEER upon telephonic subjects. It appears to me that you are rendering the entire fraternity, and particularly the telephonic section, a valuable service in the stand that is taken therein.

From recent observations I am certain that within the next few years the independent movement is going to suffer very seriously from the evil of too cheap construction. I have seen many plants that are attempting to give service upon a basis that will most certainly wreck them within the very immediate future. I have also seen a number of manufacturers who are attempting to sell goods of such a quality as will entail an extremely high maintenance to keep them in working order.

That a certain amount of such error is unavoidable in parties undertaking a business in which they have no experience is certain, but it appears to me that the amount of poor construction and poor service that is now in the field is all out of proportion, and I am sure that the kind of warning which you are giving in your columns should be of the greatest value to those who are attempting to go into the business with a meager equipment of experience.

A few days since the manager of a large independent exchange innocently remarked to me, that they had no depreciation because their plant was new. The effect of such a state of mind upon the management of so complicated and expensive installation as a telephone plant is simply appalling.

You are most unquestionably right in the assertion, that telephone service upon a large scale is much more expensive than on a small scale, and in this respect telephonic service certainly differs widely from many other lines of business, in which expense is cheaper in proportion as the business grows.

In telephony, on the other hand, all items of expense increase rapidly with the dimensions of the service. As the number of subscribers increase the ability of each subscriber to talk increases, the call rate rises, and thus there is more use of the telephone for a subscriber in a large exchange than in a small one. There is, consequently, more depreciation, more maintenance and more cost. This necessitates a large plant in all directions, and increases the investment as well as increasing the rates of maintenance and depreciation.

It is astonishing that a paper so intelligent as the *New York Times* should fail to perceive this very apparent fact, and as a subscriber to the ELECTRICAL WORLD AND ENGINEER, entirely independent of any telephonic affiliations, I am certainly grateful to the paper for the knowledge conveyed in the recent editorials.

The factor of public telephonic education is another extremely im-

portant point. It is surprising to me how few people have any knowledge of rightly using the telephone as an instrument, or the laws which obtain in telephonic service.

It appears to me that if the American Bell had departed long ago from their apparently mistaken policy of secretiveness and had taken the public into their confidence and had endeavored to educate them telephonically, that the present situation would have been largely, if not entirely, avoided. It is impossible for an exchange manager to do more good either to the subscriber or to his company than to use every effort in his power to give every subscriber a full and complete telephonic education.

PHILADELPHIA, PA. H. L. MANTON.

# DIGEST
OF
# CURRENT ELECTRICAL LITERATURE.

## DYNAMOS, MOTORS AND TRANSFORMERS

*Heyland Induction Motor with Power Factor Equal to Unity.*—E. H.—A French translation of Heyland's German article (Digest, Aug. 31, see also ELECTRICAL WORLD AND ENGINEER, Sept. 28, p. 492). The motor, he says, can also be used as a generator and furnish current independently of any other machine. It is self-exciting, its frequency is not, as in other alternators, absolutely fixed by the angular velocity, but depends upon the charge. The translator remarks that this seems to be an inconvenience, as the good operation of the motors fed from an alternating-current network, depends upon the constancy of the frequency.—*L'Ind. Elec.*, Sept. 10.

HEYLAND.—A reply to this criticism. He states the means for making the frequency absolutely constant for his generator also. "This device consists simply in driving the governor of the engine by a small motor fed with the current of the alternator, instead of by the engine itself." By this means, for the operation of different machines in parallel, the general frequency is kept constant.—*L'Ind. Elec.*, Sept. 25.

*Direct-Current Dynamo Design.*—HILL.—An article in which he discusses Mavor's paper (Digest, Oct. 12). He thinks that the most important point of the same is that in which it is proposed in designing machines, to commence at the commutating parts, and having settled their proportion suitably for sparkless collection, to build the remaining parts of the machine around them. He discusses at some length Mavor's method of determining the non-sparking proportions from the relationship of the average e. m. f. generated per section of the armature to the reactance voltage of a section undergoing commutation, the ampere turns per pole of armature not exceeding 25,400 per inch-length of air space.—Lond. *Elec. Rev.*, Sept. 20.

REFERENCES.

*Synchronous Converters.*—DE MARCHENA.—His long paper, read before the Internat. Soc. of Elec., in Paris, on the theory and practice of synchronous converters. He first deals at some length with the theory of the ratio of the alternating to the direct-current voltage, the armature loss, and the armature reaction. He then describes the method of starting, and treats the question of stability of working and capacity of standing overloads. He then discusses the regulation of voltage by field excitation, and deals at some length with compound and shunt excitation. The paper is concluded by some remarks on operation in parallel, and on the use of synchronous converters for converting direct current into alternating current.—*Bull. Soc. Int. des Elec.*, May.

*Electrolytic "Valves."*—BLONDIN. His paper in full read before the Internat. Soc. of Elec. in Paris on the Pollak system of electrolytic "valves" for converting alternating into direct current, an abstract of which has been noticed at length in the Digest.—*Bull. Soc. Int. des Elec.*, July.

## LIGHTS AND LIGHTING.

REFERENCES.

*Bremer Arc Lamp.*—LAPORTE.—His paper in full, read before the Internat. Soc. of Elec. in Paris, on photometric tests of the Bremer arc lamps, an abstract of which has been noticed at length in the Digest.—*Bull. Soc. Int. des Elec.*, July.

*Arc Lamp.*—BAINVILLE.—An illustrated description of an arc lamp of the Gen. El. Co., of Nancy.—*L'Elec.*, Sept. 21.

*Advertisement Lighting.*—The first part of an illustrated article on the system of electric advertisement lighting of the Gen. Elec. Co., of Berlin.—*Zeit. f. Beleucht*, Sept. 20.

## POWER.

*Use of Electric Power for Making Water Gas.*—SCHMIDT.—A paper read before the Zurich section of the German Elektrochem. Society. In the process of making water gas, water steam is conducted over glowing coal, with the result that CO and hydrogen are formed. The process absorbs much heat, as in the combustion of C to CO only about half the number of calories which are required for the decomposition of the water are set free. The furnace must, therefore, be supplied, from time to time, with fresh heat. If 42 cubic meters of water gas are produced from 12 kilograms of pure carbon—about 13.5 kilogram of coke—there are missing 28,970 calories, for which about 8.8 more kilogram of coke are required. If instead of the latter, electric heating is used—an efficiency of 80 per cent being assumed—about 42.5 kilowatt-hours are required. If the price of coke is 1 cent per kilogram, the process of electric heating is economical, if the electric power costs not more than 0.21 cent per kilowatt-hour. He thinks that electric power can be furnished at this price at many places in Switzerland, especially at certain hours of small load. Switzerland must import all its coal, but is rich in water powers.—*Zeit. f. Elektrochemie*, Aug. 1.

REFERENCES.

*Traveling Cranes.*—HAHN.—An illustrated article on electric motors for traveling cranes. He discusses the different types of motors used for this purpose and the method of control.—*Elek. Anz.*, Sept. 8, 12, 19.

*Electric Driving.*—HAHN.—A mathematical article on the electric driving of grinding machines.—*Elek. Anz.*, Aug. 29.

*Gas Engine.*—MONTPELLIER.—An illustrated article on the Oechelhaeuser gas engine.—*L'Elec.*, Aug. 24.

## TRACTION.

*Trolley System vs. Battery Traction.*—An illustrated article on the conversion of the Englewood and Chicago storage battery road to the overhead trolley system. The road was built five years ago, and at that time comprised 12 miles of track. Extensions and branch lines were installed, with which the company now operates a trackage of 28 miles, consisting of 10 miles of double track and 8 miles of single track. The change to trolley operation was mainly necessitated by the difficulty in operating the branch roads economically, as under the storage battery system it was necessary either to build new charging stations or to run branch line cars to the power house every trip for a charge, thus wasting considerable mileage. The original system of charging the batteries was with three different voltages, but later it was found that it is more economical to charge the batteries in groups. Enough batteries were placed in each group to constitute a full load on one of the station generators, of which there were four, each of 190 kilowatts and 200 volts. The charging voltage was begun at 165 volts, and as the generators were shunt wound, they permitted the voltage to increase as the ampereage dropped. When a voltage of 185 was reached, the batteries were considered fully charged. About the same time was used in charging the cells as was consumed in discharging them on the road. The greatest number of miles run by any one battery was 27,449.6, while the average mileage of 62 batteries was 23,125.1. Battery depreciation increased on the batteries toward the last, until it averaged 2.276 cents per car-mile. Under the storage battery operation everything ran successfully and smoothly from a mechanical point of view, but the expenses were too great. Another reason for the change was that the capitalists who had originally built the plant had been interested in a storage battery manufacturing concern, while this connection

has later been severed. The present station is described. The trolley system has now been in use for some weeks. The operating expenses of July 1899 under the battery system and July, 1901, under the trolley system are compared. Of the following numbers the first refers to the battery system, the second to the trolley system: Total expense per car day, $16.2, against $11.9; total expense per car-mile, $0.112, against $0.074; total power station expense, $1,172, against $1,660; pounds of coal per kilowatt-hour, 8.606, against 11.638; power station expense per car-mile, $0.0149, against $0.0168. While since the introduction of the trolley system the power house operating expenses have increased, this is offset by the saving in wages and depreciation. The manager of the road is of the opinion that there is to-day no better, cheaper, or more satisfactory system of street railway traction, with the exception of overhead trolley, than storage batteries, provided that the charging stations are at the ends of lines, that no more than 10 miles are run upon one charge, that there are no grades of over 4 per cent, and that the number of cars run from such charging stations is at least 20.—*West. Elec.*, Oct. 5.

*High-Speed Electric Railways.*—G. W. MEYER.—A discussion of the relative advantages of the different systems for high-speed electric railways. The direct-current system with third rail is said to be practical only for short distances and for light trains, more especially for city and suburban service. Geared high-speed motors are better than gearless motors. The latter are used on the Wannsee Railroad. A system of alternating-current transmission with substations for converting to direct current should be used in such cases in which the pure direct-current system is impractical on account of great distances or in cases where the traffic would require too thick feeders. He discusses at some length the two kinds of three-phase systems; the one in which high-tension currents are directly supplied to the motor cars; the second, with step-down transformers placed along the line for supplying three-phase current of lower tension to the motor cars. The first of these two systems has the advantage of less first cost of installation, less loss of energy in the line, but it is not as safe as the second one, which is always preferable when the traffic is great and the first cost and cost of maintenance are of less importance than safety of traffic. The first system, however, seems to be the system of the future, as it is to be hoped that railway motors for very high voltages can be constructed and full safety of working can be obtained with them. A frequency lower than 22 periods should not be used.—*Elek. Anz.*, Sept. 12, 22.

*Tramway in Sicily.*—BIGNAMI.—An illustrated article on a combination of electric and cable systems on a short line between Rocca and Monreale in Sicily, which is only two miles long, but contains a grade too steep for ordinary railway operation. This line is made up of three sections—a single-track length of about 700 ft., the second a three-rail double-track portion about 1200 yards long, with one rail common to both tracks, and with a turnout half way, and the third, again a single-track section, about 800 yards longs. On the double track part the auxiliary cable driven motor cars are used. The electric motor cars are supplied from an overhead conductor by the ordinary trolley system. The auxiliary motor cars, two in number, run on a special narrow-gauge track, laid between the regular track, and are connected by a cable, so that when one is at the lower end of the double-track section, the other is at the upper end, gravity being made use of. The auxiliary cars are placed at the rear of the electric cars. At the lower end of the double-track section there are arranged between tracks properly graded pockets, each large enough to accommodate one of the auxiliary cars, so that the regular passenger car coming from Palermo can pass over it. At the same time, the other car, coming from Monreale at the head of the grade, runs up behind the upper auxiliary car there and is coupled to it. The two cars from the upper stations descend several yards until the auxiliary car at the foot of the grade, which thus is drawn from its pocket, reaches the car at that end with which it has to climb. After reaching the head of the incline the passenger car continues on its way alone, while the brake car is ready to return with another car which may have arrived by that time.—*Cassier's Mag.*, Oct.

*Electric Trial Service on the Vienna City Roads.*—An account of trials which have recently begun on the Vienna City roads with a view of introducing electric traction. The trials are made on a line of 3.8 km. in length, with an average grade of 0.8 per cent; 1.6 km. of this line is curves. Besides the two-end stations there are two intermediate stations. The trials are made by Siemens & Halske, of Vienna. The third-rail system is used. Each train consists of two halves, each half of four cars, multiple unit control being used. Each half of the train is provided with four motors. Shunt motors are used in order to be able to run the motors as generators on grades and while braking.—*Zeit. f. Elek.*, Sept. 8.

*Rapid Transit in London.*—SPRAGUE.—An illustrated article on the rapid transit problem in London. He reaches the conclusion that rapid transit in London and its suburbs depends upon a widespread and radical application of electricity, and this is of even more importance than the creation of new tunnels. Locomotive practice should be abolished and trains be operated in small units which could be combined at will. Electric trams should be provided in place of many of the bus lines on crowded streets, and radiate from every terminus of tubular railways and from most of the suburban stations. Every steam railway should equip at least its suburban service with electricity on a plan which permits of variable train lengths, plural control, high schedule speeds, and the maximum use of existing tracks.—*Eng. Mag.*, Oct.

*Metropolitan Street Railway, of New York.*—PEARSON.—An illustrated article on the electrical distribution of the Metropolitan St. R'y Co., of New York. This distribution is notable as being the largest polyphase alternating-current distribution for railway purposes yet put in operation. The amount of energy required per square mile of territory served is also very heavy. Before the Metropolitan distribution was decided upon, estimates were made on two direct-current power houses to serve the same territory as the one polyphase power house serving it at present. The territory was about nine miles long, and about two miles wide. The preliminary estimate for two direct-current plants, including the real estate and the feeder system necessary to deliver the current at the conductor rails, was $1,650,000 higher than for one alternating-current plant with six sub-stations and all feeders for a capacity of 26,000 kilowatts. The present power house at Ninety-sixth Street has eight 3500-kw generators in operation, three more being installed. These generators have a voltage of 6400, and this current is transmitted by underground conduits to seven sub-stations. At the sub-stations, step-down transformers and rotary converters are used to give a direct current of 550 volts. The power house switchboard is a matter of much importance where such large amounts of current are to be controlled at such high voltage. The oil-break switch is used throughout and several switches are placed in each generator and each feeder circuit, so that the failure of one would not prevent the opening of the circuit. The switches are pneumatically controlled by electrically operated valves. They have never failed in an emergency that has yet arisen, though called on at times to break no less than 2000 amperes. From the power house to the sub-stations three-phase currents are conducted in lead-covered three conductor cables. Paper insulation has been found much more satisfactory than rubber for these high-tension cables. The insulation is 5.5 mm. thick. All apparatus is tested at 25,000 volts for five minutes before being put in service. At manholes the high-tension cables are protected by sheet steel covering. The company has both vitrified clay conduits and iron pipes cement lined. The vitrified conduit has proved by far the most satisfactory because it stands up the best under short circuits. There is enough heat resisting material in the vitrified conduit to confine the destruction caused by a short circuit to one duct, while in a cement-lined iron pipe the heat spreads and destroys several adjacent ducts and cables. Rotary converters at the sub-stations are run with plain shunt-wound fields, although the original plant was to use compound winding on the fields. At each sub-station is a storage battery of a capacity of about 25 per cent that of the rotary converters. This takes up the fluctuations and is used in emergencies and during times of light load when the generating machinery is shut down for the cleaning of switchboards. The all-day efficiency of the distribution of the generators in the power house to the direct-current feeders going out from the sub-stations, is from 90 to 91 per cent. There are 750 switchboard instruments on the system, and two men are constantly at work keeping them correct. Load curves for 24 hours are shown. The maximum output is at 6.55 p. m., when it reaches 22,000 kilowatts.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

*Comparison of Three Large Traction Stations in New York.*—KENT.—A very long and well illustrated article. The three plants discussed are those of the Metropolitan Street Railway Company, the Manhattan Railway Company (elevated railway), and the Third Avenue Railway Company at Kingsbridge. These stations are much larger than any that have hitherto been built for traction purposes. The maximum capacity of the Metropolitan Station is estimated as 66,000 horse-power, and that of the other two stations when com-

pleted will be 100,000 horse-power each. The electrical problem of each of the three stations is to furnish current to several sub-stations located at different points throughout the whole of Manhattan Island and a part of the Bronx district. Three-phase currents of a frequency of 25 cycles per second have been adopted by all the stations, furnished by alternators with revolving fields, containing 40 poles and revolving at 75 r. p. m. A critical review and comparison of the principal features of the three plants is given.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

*Borough of Bronx.*—MAHER.—An illustrated description of the lines in the Borough of Bronx, New York, which are all operated by trolley. In 1892 the company was running only 20 horse cars, whereas now 400 electric cars are required for the service.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

*General Electric System of Train Equipment.*—A complete illustrated description of the General Electric system of multiple unit control which will be used on the Manhattan Elevated Railway in New York. To obtain the highest speed schedule it is necessary not only to have quick acceleration but rapid braking. The motors of the train are controlled from one point, or any motor car can be operated separately. This is arranged by having on each car a number of electrically operated switches, constituting practically a series parallel controller except that there is no revolving cylinder and instead the contact fingers are raised up and down. At the end of each motor car are other controllers called master controllers, which instead of controlling the motors operate the contact switches first named These master controllers are somewhat similar to the ordinary car controllers, only they are much smaller. A cable connects all the controllers of the train. The current of the controllers does not pass through either the master controller or the train cable, as these parts carry only enough current to operate the contact fingers. Each motor car collects its own motor current from the trolley or third rail, and this passes into its own conductors. Each motor controller is also furnished with a reversing switch. The Manhattan Elevated Railway Company will also use a special motor called G. E. 66. The frame is of cast steel and the pole pieces of soft iron. The motor is well ventilated. Full particulars of the construction are gvien.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

*Alumino Thermic Process of Rail Welding.*—ARCHDEACON.—An article on an improvement in the Goldschmidt method of welding rail joints, which has been described previously in the Digest. The crucible in which is contained the alumino thermic iron, is plugged at the bottom with an iron plug. It is then lighted by ignition in the usual way. When the mass becomes molten, the heat melts the iron plug and the molten mass passes out through the bottom around the rail. In this way the metallic contents of the crucible are first poured around the rail, and after the metal comes the slag. The reverse of the process follows when the metal is poured out of the top of the crucible, that is, the slag will then come first. This, it is thought, gives a much better joint. The amount of "thermit" necessary for a weld depends on the size of the rail, but for a rail weighing about 50 kg. per meter the ordinary quantity is from 8 to 10 kg. per joint.—*St. R'y Jour.*, Int. Ed., Oct.

*Trolley Wire Protection.*—An illustrated article on trolley wire protection in Santiago de Chile. While originally it had been decided that the ordinary system in which the guard wire is earthed to the rail, should be used, a modification has now been devised by Salazar, in which the guard wire is connected to the rail through a definite resistance. The connections of both systems are shown in diagrams. The new system is claimed to be safer and cheaper.—Lond. *Elec. Rev.*, Sept 27.

REFERENCES.

*Block Systems.*—RANK.—An illustrated paper on the different block systems for railways which were exhibited at the Paris Exposition. He deals with the following non-automatic block systems: Lartique, Tesse and Prudhomme, Tyrer, Paris-Lyon-Mediterranean system, Sarroste and Loppe, the systems of the French Eastern Railway and the French Western Railway, Cardani, Chassin, Siemens & Halske. Furthermore, with the following automatic blocks systems: Westinghouse, Hall, Krizik.—*Zeit. Oest. Ing. u. Arch. Verein*, Sept. 13, 20.

*New York City.*—FORD.—A very long and profusely illustrated article on "The traffic conditions of New York City," with numerous maps and statistical tables, covering all the lines in Greater New York.—*St. R'y Jour.*, Oct. 5, and Int. Ed., Oct.

*New York City.*—Illustrated articles on the traffic and traffic conditions on Manhattan Island. The system of the Metropolitan Street Railway Company, the rapid transit tunnel and railway, the Manhattan elevated system, the system of the Brooklyn Rapid Transit Company, and track construction on the same.—*St. R'y Rev.*, Sept.

### INSTALLATIONS. SYSTEMS AND APPLIANCES.

*Charging for Electrical Energy.*—WILKENS.—A brief communication in which he criticizes the system of charging proposed by Kallmann, as abstracted in the Digest last week. He thinks it unfair to base this method upon the number of lamps connected to the supply network, instead of the maximum demand really obtained. If Kallmann's method would take into account the latter, a maximum demand indicator would be required in addition to his registering instrument. A still greater disadvantage is said to be the simple addition of the loads in each stage, without taking into account the hours of the day, so that Kallmann does not take into account whether the consumer's load influences the maximum load of the plant or not.—*Elek. Zeit.*, Sept. 12.

REFERENCES.

*Starting Resistances.*—KUBIERSCHKY.—An illustrated article on Bunet's method of calculating starting resistances, which he tries to show by diagrams to be not fully correct.—*L'Ind. Elec.*, Aug. 25.

BUNET.—A reply to Kubierschky's criticism, which, he tries to show, is incorrect.—*L'Ind. Elec.*, Sept. 10.

### WIRES, WIRING AND CONDUITS.

REFERENCE.

*Contact Resistances.*—A. H.—A long table, giving the results of measurements of contact resistances, the contacts being made between pieces of various metals and of various forms, by means of screws, under pressure, etc.—*Elek. Anz.*, July 25.

### ELECTRO-PHYSICS AND MAGNETISM.

*Dielectrics.*—VON HOOR.—A long account, with tables and diagrams, of very extended experimental researches made with impregnated vegetable fibre dielectrics, paraffine, gutta percha, glass and micanite condensers. He calls attention to the many sources of error due to small air bubbles, imperfect impregnation due to sticky impregnating material or too low a temperature, traces of acid or impurities. Traces of chlorine have a bad influence and the author believes that the reason why cable manufacturers prefer manila fibre to the more suitable linen fibre, is that they fear bad effects due to the chlorine which has been used in bleaching the linen fibre. Line fibre, jute fibre or manila fibre, if perfectly pure and free of air and impregnated with easily fusible and chemically pure paraffine have qualitatively entirely the same properties. He gives the results of his tests in tables and diagrams. Many of his experiments dealt with the residuum phenomena in dielectrics. The specific resistance is of great influence; in dielectrics with low specific resistance the residuum phenomena are strong and slow. The thickness of the dielectric layers is also of great influence. He found that results of tests concerning the dielectric properties, and more especially residium phenomena, can be directly compared only if the thickness of the layers in the tests is the same. He concludes that the processes in a volume element of a dielectric and the equilibrium in the same are influenced not only by the particles in the immediate neighborhood, but also by those farther away. There is a close analogy between the molecular mechanisms of the magnetic and of the dielectric polarization. He refers to similar well-known facts, for instance, that the breaking-down voltage does not increase proportionally to the thickness of the dielectrics.—*Elek. Zeit.*, Sept. 5, 12, 19.

*Magnetic Effect Due to Electric Convection.*—CREMIEU.—A very brief abstract of a paper read before the Brit. Ass'nt Adv. Sc. His experiments have lead him to think that there is no magnetic effect due to electric convection, as has been repeatedly noticed in the Digest. Cremieu's method, dealt with in the present paper, consists essentially "in suddenly charging a rapidly-moving surface spinning inside a coil placed in a galvanometer circuit." The sudden convection current thus established should have induced a current in the coil, but no such induction took place. In the discussion, Wilson thought that the negative result was due to the "screening effect of the charge induced in the stationary metallic parts of the apparatus. He conceived that as the charge moved round with the rotating part of the apparatus it drew round with it an equal and opposite charge in the metal shrouding of the apparatus, this producing a neutralizing

convection current." Larmor did not admit the validity of Wilson's criticism and considered Cremieu's experiments as "good experiments well carried out." He confessed that if Cremieu's conclusions are correct they would revolutionize completely our ideas of the relationship of electricity to matter and the convenient electron would have to be abandoned. Lord Kelvin said what is needed is to repeat the very fundamental experiment as carefully as modern appliances will admit, viz., that a charge should be rotated in proximity to one needle of an astatic pair, the apparatus being reduced to its simplest possible elements in order to eliminate criticism as to the disturbing influence of unnecessary parts. He professed to be fully convinced that electricity in motion must produce an electromagnetic field.—Lond. *Elec.*, Sept. 20.

*Magnetic Effect Due to Electric Convection.*—EICHENWALD.—An illustrated account of experiments in which he has repeated Rowland's experiment which proved the existence of the magnetic effect due to electric convection. He took every precaution and obtained Rowland's effect. He regards Cremieu's negative result as due to disturbing influences.—*Phys. Zeit.*, Sept. 7; abstracted in Lond. *Elec.*, Sept. 20.

*Resistance and E. M. F. of the Electric Arc.*—DUDDELL.—A long abstract of a Brit. Royal Soc. paper. He experimented with a direct current upon which an alternating-testing current was superimposed. In order to prove that the arc has a true resistance and to find its value, he showed that it is possible to find a value of the frequency of the testing current for which the power factor of the arc with respect to this current is unity, and that the power factor remains unity and the impedance constant, even when the frequency is greatly increased above this value. When the value of the impedance of the arc is determined under these conditions, this will be the true resistance. With an arc 3 mm. long between 11 mm. solid carbons, the power factor becomes unity for the extremely high frequency of 90,000 p. p. s., produced by a special generator, and it remained unity up to 120,000 periods. The true resistance of this arc through which a current of 9.91 amperes was following was found to be 3.81 ohms. The ohmic drop is, therefore, 37.8 volts out of an observed p. d. of 49.8 volts, so that there appears to be a real back e. m. f. opposing the flow of the current in this arc of 12 volts. With an arc 3 mm. long between 11 mm. cored carbons the power factor became unity at a frequency of 15,000 p. p. s. and remained unity up to 50,000 periods. The true resistance of this arc was found to be 2.54 ohms and the back e. m. f. 16.9 volts. Both the resistance and the back e. m. f. depend greatly on the composition of the electrodes. Thus, simply soaking a paid of solid carbons in potassium carbonate reduced the resistance of the arc between them from 3.81 to 2.02 ohms, and increased its back e. m. f. from 12 volts to 15.6 volts, the arc length and direct current being kept constant. Similar results were obtained by introducing other impurities. He is of the opinion that the resistance between perfectly pure carbon electrodes would be very high, so high that it might be impossible to maintain a true arc, and that traces of impurities are essential to provide the carriers of the electric charges in the vapor column.—Lond. *Elec. Rev.*, Sept. 20.

*Velocity Ratio.*—ABRAHAM.—An account of some of the most important experimental methods recently used for determining the velocity ratio, i. e., the ratio between the electrostatic and electromagnetic units of quantity of electricity. The mean of the seven measurements which are considered the most accurate is $v = 30{,}001{,}000{,}000$. —*Paris Internat. Phys. Congr. Report* 2, p. 247; abstracted in *Science Abstracts*, Aug.

## ELECTRO-CHEMISTRY AND BATTERIES.

*Separating Cobalt and Nickel.*—BALACHOWSKY.—An abstract of an French Academy paper, describing an electrolytic method of separating these two metals. The only method at present is a chemical one which is rather tedious. The difficulty lies in the identity of the chemical and physical properties of these two metals. He uses an acetate solution mixed with other ingredients. The composition is given. The electrolysis must be carried out at a certain very definite voltage, current density and temperature. The description is not clear, as the meaning of certain reference letters is not given. It seems, however, that below a certain density both cobalt and nickel are deposited, while at a certain other current density and voltage only the nickel is deposited and the cobalt left in solution. (Unfortunately, as in numerous other similar descriptions, nothing is said of the relative position of the electrodes with reference to each other, which so greatly affects the internal resistance, and, therefore, the voltage at the terminals. If this voltage must be so carefully adjusted the portion lost by internal resistance ought to be just as carefully stated.)—*L'Ind. Elec.*, July 25.

*Nickel Cells.*—MICHALOWSKI.—A communication on the history of the use of nickel oxide electrodes in storage cells. Dun, in 1885, took out a German patent for a nickel-alkali-zinc cell; Desmazures, in 1887, patented a method of making electrodes of porous nickel; Michalowski, in 1899, patented a new process of making nickel electrodes. He was also the first who called attention to the thermochemical properties of nickel, which make this metal especially adapted for the positive electrode.—*L'Ind. Elec.*, Aug. 25.

*Edison Battery.*—LUCAS.—A reply to Wade's criticism (Digest, Sept. 28). He maintains that the voltage required for electrolysis of any aqueous solution depends on the electrolyte in solution and not on the water, otherwise the voltage required to electrolyze solutions would be the same no matter what salts or bodies are present. He claims that local action "might take place in Edison's negative, even if it were true that the p. d. of the couple graphite-iron were equal to the p. d. required to split up the solution present."—Lond. *Elec.*, Sept. 13.

REFERENCE.

*Contact E. M. F. and the Theory of Ions.*—A French Academy note. The Lipmann electrometer enables one to determine the contact e. m. f. between mercury and the electrolyte, if one admits that at the moment when the capillary surface tension becomes a maximum, there is no e. m. f. between the liquid and the capillary mercury. He studied the variation of the e. m. f. with the concentration of the solution. The experimental results are in agreement with the theory of ions for dilute solutions.—*L'Ind. Elec.*, July 25.

## UNITS, MEASUREMENTS AND INSTRUMENTS.

*Hot Wire Wattmeter.*—E. H.—An illustrated description of an interesting and extremely simple hot-wire wattmeter for direct and alternating currents, devised by Bauch. The two hot wires *a* and *b* are arranged in combination with two additional resistances *c* and *s*, as shown in the adjoining diagram. Under the supposition that the

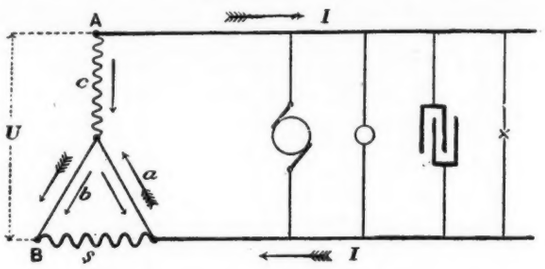



FIG. 1.—HOT-WIRE WATTMETER.

elongation of a hot wire is proportional to the heat developed in it, it is shown that the difference of the elongations of the two hot wires *a* and *b*, is proportional to the product of the e. m. f. *U*, the current *I* and the cosine of the phase difference between *U* and *I*; in other words, this difference is a measure of the real power. The device by which the needle of the instrument gets a deflection, proportional to the difference of the elongations of the two hot wires, is very simple

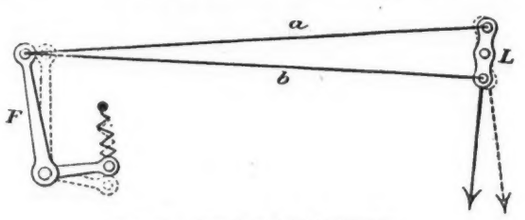



FIG. 2.—HOT-WIRE WATTMETER.

and is shown in the second figure, in which *a* and *b* are again the two hot wires. They are fixed at one end to the lever *F*, acted upon by a spring. The other ends of the two wires are connected to a lever *L* with two equal arms. For slight elongations, the deflection of *L* is proportional to the difference of the elongations of *a* and *b*, and hence proportional to the power to be measured.—*L'Ind. Elec.*, Sept. 10.

## Features and Exhibits of the Street Railway Convention.

A special 12-page supplement to ELECTRICAL WORLD AND ENGINEER last week gave a report of the convention of the American Street Railway Association up to the time of going to press, as well as details and views of many of the exhibits. Elsewhere in this issue, we close this week our notes, etc., on the convention, and below will be found some further data as to the exhibits, many of which, for importance and completeness, have never been equaled. We are also able to supplement with views our descriptions given last week of the excellent exhibits of the Westinghouse Electric & Manufacturing Company, A. & J. M. Anderson, the Gold Car Heating Company, General Electric Company, Creaghead Engineering Company, and the Bay State Electric Car Heater.

THE N. Y. TELEPHONE COMPANY gave an excellent free telephone service at the Garden, and the convenience was highly appreciated by all. Mr. F. H. Bethell, the company's contract agent, placed his temporary Bell exchange in the music balcony over the main entrance into the Garden. It consisted of a two-position switchboard connected with the Madison Square central office by 20 direct lines. To the board were connected 58 long distance telephone stations located at various parts of the Garden in leading exhibits. The "private branch exchange" service was thus illustrated in a most excellent manner. There were also a group of sound-proof booths in the temporary exchange for general use. The New York Telephone Company which now has 64,000 stations in Manhattan alone, and is growing at the rate of 1500 a month, was able to give a splendid test of its system under the great pressure put upon it by the convention work. A neat little brochure on private branch exchange service was distributed.

THE BETHLEHEM STEEL COMPANY, on Saturday, after the close of the convention, took a special train with about 200 delegates and ladies out to their fine works at Bethlehem, where four or five thousand men are employed, and where some of the largest guns and heaviest armor plate in the world are made. All this work was, of course, intensely interesting, but at least equally so were the superb steel shafts turned out and being cut by machine tools of Taylor White steel, which will cut steel so rapidly that the chips are heated to a blue tinge. Seeing is believing, but it is even then difficult to persuade oneself that the metal can be worked at such a high rate of speed. Some of the shafts in hand are intended for the new Riverside station of the New York Edison Company and for the power plant of the Manhattan Elevated. A very interesting feature was the "fluid compression" plant. Many devices have been projected to obviate the various defects in ingots, such as blow-holes, segregation, piping, etc., which occur in the cooling of large masses of steel, but the most successful of these devices is the "fluid-compression" process, by which ingots are secured free from defects or flaws of any kind, and the metal is rendered homogeneous throughout. This fluid-compression plant is the only one in this country. In the forge two hydraulic presses, one of 2500 tons and the other of 5000 tons capacity, were operated, forging such work as was found ready at the time. The best practice now calls for steel forgings to be manufactured under heavy hydraulic presses, instead of hammers, as formerly. It is only by means of these improved methods that the metal of the forging is thoroughly worked throughout. The process of hollow-forging on a mandrel, which could be seen under these presses, is one of the latest improvements in the forgeman's art, and a large proportion of the steel forgings turned out by the Bethlehem Steel Company is now of this type. A most enjoyable collation was served in the office building, and many thanks are due Mr. Fitz John Porter, and other officials of the company, for a very delightful day.

FRANK RIDLON COMPANY, of Boston, made an exhibit of its specialties, including the Wilson trolley catcher, the Ridlon track drill, and the Weld babbitting device, the latter being a new piece of apparatus for babbitting split bearings in which the work is automatically completed by simply pouring the babbit. Skilled labor is not necessary to cast bearings with this device. Messrs. Frank Ridlon, president; Charles N. Wood, vice-president; N. L. Wood, H. F. Kellogg and Robert Mathias were present.

GLOBE ELECTRIC MANUFACTURING COMPANY, Cleveland, Ohio, exhibited its headlights in the Morris Electric booth. Mr. George Scroder represented the company.

THE AUTO-ELECTRIC SHUNT COMPANY, West New Brighton, New York, which manufactures a device for substituting an incandescent lamp for any one in a series of lamps that may burn out, had some of its shunts on exhibition. Their action was explained by F. W. Wise. The apparatus has been illustrated and described in the pages of ELECTRICAL WORLD AND ENGINEER.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, of Cincinnati, had an exhibit of its line material and general supplies in the space of the

FIG. 1.—CREAGHEAD ENGINEERING COMPANY'S EXHIBIT.

Morris Electric Company, which represents it in the East. Mr. Harten was in attendance.

THE VANDORN-ELLIOTT ELECTRIC COMPANY, of Cleveland, had a neat exhibit of commutators, armature and field coils and a rewound armature as a sample of the work that it does. W. H. Elliott and W. A. Dutton represented this company.

R. D. NUTTALL COMPANY, Pittsburg, had a few gears and pinions and Nuttall trolleys on hand. The Nuttall factory, the largest of its kind devoted exclusively to gears in the United States, is being crowded with street railway work, and is also with turning out gears for other purposes, some of very large size. Messrs. F. A. Estep and L. W. O'Brian were present.

FIG. 2.—BAY STATE CAR HEATER EXHIBIT.

DRAKE, BREED & CO., engineers and contractors, of Philadelphia, was represented by both members of this firm, which has under contract the construction of the Hamburg Railway, now nearly completed from Buffalo to Hamburg. Plans for an extension to Dunkirk are being prepared. The firm has some other very important work in sight, and its services are greatly in demand.

THE CHASE-SHAWMUT COMPANY, of Boston, well known in the electric lighting field, exhibited the Chase-Shawmut flexible rail bond,

which uses solder for attachment to the rail, and has been used at Seattle as well as on other Stone & Webster street railway properties. The reports are excellent as to its durability, conductivity, and easy application. Messrs. George L. Osborn, E. M. Hamlin, F. D. Masterson and H. P. Moore attended the convention for this company.

MR. S. B. CONDIT, JR., of S. B. Condit, Jr., & Co., Boston, was in attendance at the convention on Friday. Mr. Condit discussed the merits of Elden circuit breakers and switches.

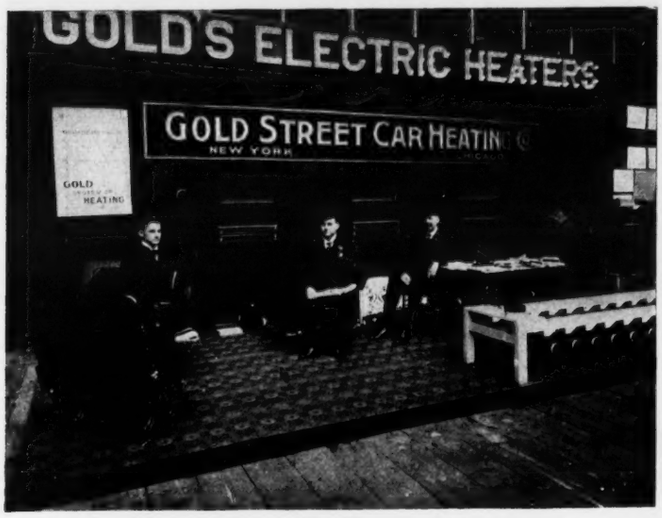



FIG. 3.—GOLD CAR HEATERS.

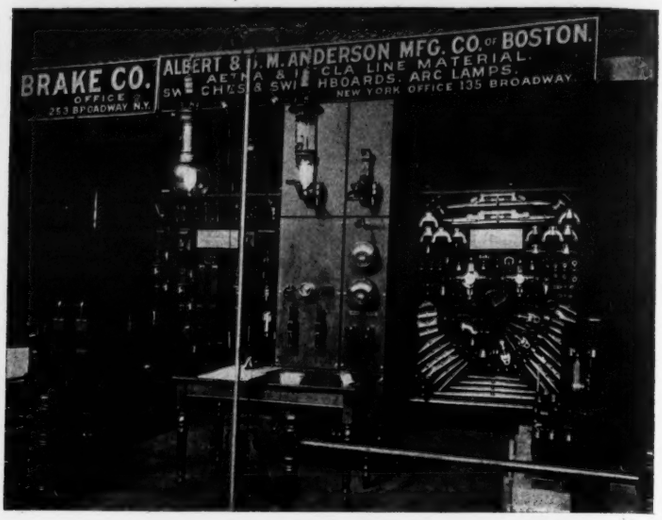
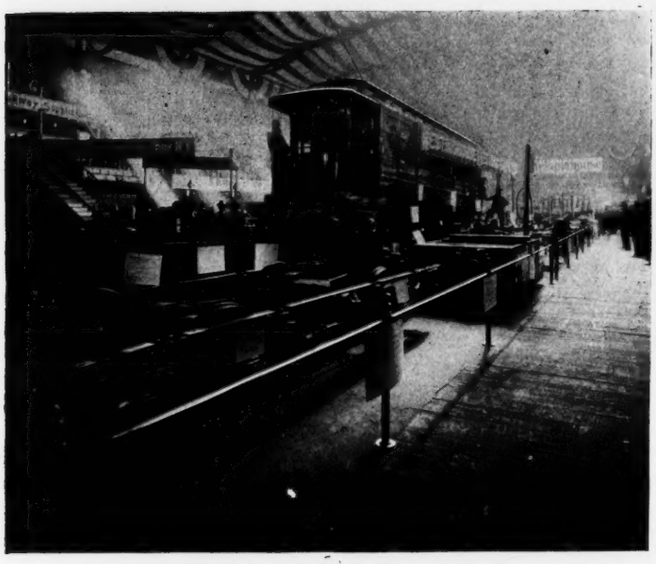
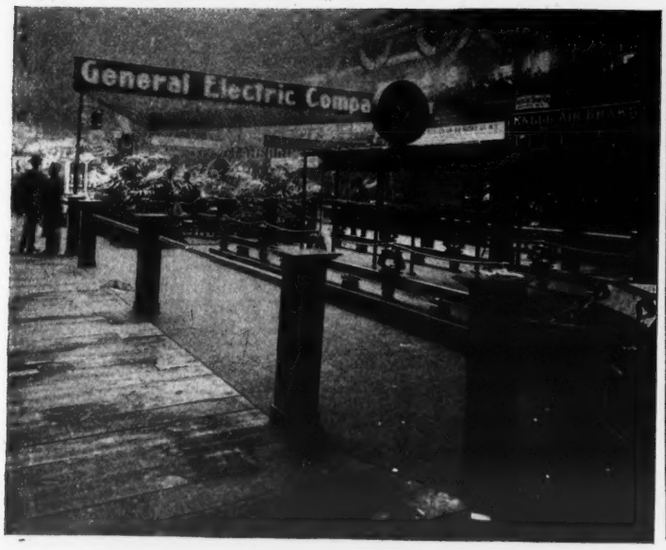



FIG. 4.—EXHIBIT OF ANDERSON OVERHEAD APPLIANCES.



FIGS. 5 AND 6.—THE WESTINGHOUSE COMPANY'S EXHIBITS.



FIGS. 7 AND 8.—GENERAL ELECTRIC COMPANY'S EXHIBITS.

THE CROCKER-WHEELER COMPANY exhibited on the central floor space two sizes of its railway generators, one complete with brush

rigging and one showing only the field magnet frame. These sizes have output of 250 and 500 kilowatts at 550 volts. Although this company owes, to a large extent, its reputation in the electrical industry to its many achievements in the development of electrical apparatus for power purposes, no little time has been given during the past few years by its engineering department to the careful consideration of the requirements of electric railroad work. The result of this consideration is a line of generators built upon the most practical design to withstand the severe stresses to which railway machines are subjected. The success attained with this new line is most satisfactory, and the operation of the machines in actual service speaks more emphatically than anything which could be said here. Their regulation is remarkable. There is no perceptible sparking at the brushes under wide variation in load, and the simple construction with liberal margin requires minimum attention; they are free from heating, which feature insures the user against burn-outs, except those which might occur from serious abuse. The special features of the design and construction are: Compactness, simplicity, strength and endurance, low-current density in windings, commutator brushes and other conducting parts; ample cooling surface and adequate means of ventilation; a substantially flat efficiency curve, and a nearly straight compounding curve, low armature reaction and no variation of brush lead. The iron and steel used for the field and armature is selected with special reference to magnetic qualities; the other materials are selected with reference to suitability for duty.

THE DARLINGTON ELECTRIC FOUNTAIN & SUPPLY COMPANY, of Philadelphia, was represented by Mr. F. W. Darlington, consulting electrical and mechanical engineer, and also by Mr. D. Scott Quintin, secretary. Some important developments are afoot, it is rumored, in this enterprise.

THE PENNSYLVANIA ELECTRICAL & RAILWAY SUPPLY COMPANY, of Pittsburg, Pa., was represented by its secretary and treasurer, Mr. Samuel F. Hammond and Mr. H. M. Laughlin, vice-president.

FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Conn., maker of the "Femco" incandescent lamps, was represented in the space of the Morris Electric Company. This company is paying special attention to street railway incandescent lamps. It is one of the younger companies in the business, but is forging its way to the front very rapidly. Mr. Jonathan Camp, the manager of the company, is a well-known and popular man in the trade, and has done considerable to make the "Femco" lamp a commercial success.

THE SPRAGUE ELECTRIC COMPANY had a very interesting exhibit consisting of the Sprague multiple unit apparatus which attracted considerable attention by reason of its simplicity, economy and perfect control of train operation. The exhibit was near the central part of the hall, and showed a complete train equipment of two motor cars and intermediate train line cars, with means for connecting up in various sequential and end to end relations. The controllers were of the type recently introduced on the Boston Elevated Railway, and of a capacity of 300 horse-power each. One was connected to four Lorain steel motors mounted on the floor, and the other to four motors loaned by the Brooklyn Heights Railroad Company, mounted on two of the latest Peckham trucks. The extreme flexibility of the system in accommodating itself to any train make-up and any emergency of service was illustrated in practical operation by no less a personage than Mr. F. J. Sprague himself. The multiple unit system has already become an essential factor in handling the congested traffic on heavy urban and interurban electric railways. Its adoption and successful operation on elevated roads in Chicago, where Mr. Sprague first reduced it to practice on a large scale, in Brooklyn and Boston, and on the Versailles division of the Western Railway of France, has demonstrated the practicability of substituting electricity for steam for all classes of congested railway service. In this system, as exemplified at the Garden, no electric locomotive is required. The train is usually made up of two kinds of cars, a motor car which is completely equipped with motors, controllers individual to their motors for determining their direction and speed, master switches and a controlling train line with connecting jumpers, and a train line car which is provided generally only with the controlling line common to all the cars. Each motor car is an independent unit, and the train may be composed of as many motor cars and train line cars as desired, its operation being in no way affected by changes in sequence or end relation of cars. Train movements, whether of speed or direction, or both, are controlled from any one of the cars through the master switches and controlling line. The speed and direction of the train is initiated at the master switch by a movement of a single handle. The operator can stop or reverse the train by a single throw of the switch handle from one side of the open position to the other. There are various automatic features that prevent interference with the proper operation of the control of train movements, and reduce the manipulation of the train to one of absolute simplicity. It becomes possible by the combination of this positive and semi-automatic control, to combine cars having controllers of different sizes, motors of different capacities, resistances of different gradations, gears of different ratios and wheels of different diameters, and to successfully operate them all from one or more controlling points. The Sprague Electric Company was represented at the exhibit by Messrs. Sprague, F. H. Shepard, G. H. Hill, H. G. Issertel, Alex. Henderson, S. H. Libby and H. M. Davis, and the apparatus was often operated by the young son of Mr. Sprague, Martin Desmond, showing its easiness of control by a mere boy of 14. The Sprague Company was under obligations to the Peckham Truck Company, the Lorain Steel Company and to the Brooklyn Heights Elevated Railway Company for courtesy and assistance in arranging for the exhibit at a late hour.

FIG. 9.—THE SPRAGUE COMPANY'S EXHIBIT.

THE ROBINS CONVEYING BELT COMPANY, of New York City, exhibited two operating model belt conveyors on a scale of 3 inches to the foot, equipped with an automatic self-reversing tripper. The metal parts of the exhibit were nickel-plated, and the whole exhibit was very handsomely gotten up. The conveyors were in operation continuously during the three days, noiselessly elevating and distributing material, and served to illustrate the types used largely in boiler and power houses for distributing coal in storage bins and piles, and also for taking it out of the storage. The company issued an illustrated book devoted entirely to descriptions of their conveyors in coal handling plant, and have just gotten out a new edition of their general catalogue containing 76 half-tone views of typical installations, copies of which were greatly in demand.

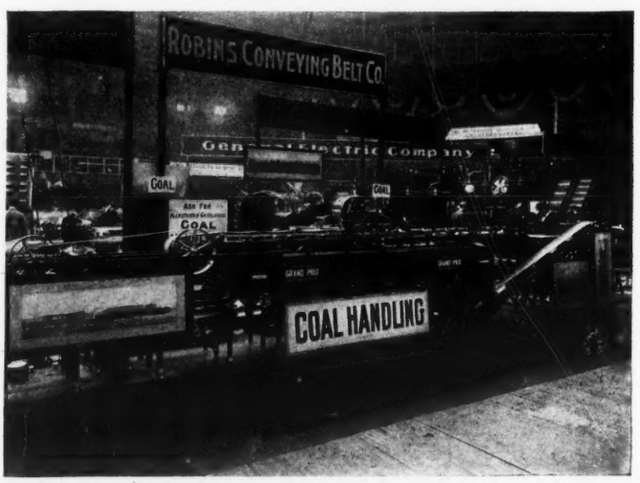



FIG. 10.—OPERATING MODELS OF ROBIN'S CONVEYOR.

# NEWS OF THE WEEK.

## Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call closed at 3 per cent, nominal. Time money was easier, and the demand more active. The closing rates are 4¼@4½ per cent for high-grade loans, and 4¾@5 for mixed collateral. At the beginning of the week the stock market was unsettled and depressed, but later in the week railroad share values rallied sharply on free covering of shorts and buying for long account. Other classes of securities were favorably affected. Amalgamated Copper attracted the most attention early in the week and declined sharply on further selling pressure, accompanied by reports that a cut in the price of the metal would probably be made. The stock, however, rallied strongly towards the close of the week. In the traction list Brooklyn Rapid Transit was the most active, there being a disposition to cover on the part of shorts, in spite of what is regarded as the poor showing of the annual report of the company. The lowest point reached was 55⅞, the highest being 61½. The total number of shares sold was 240,110, the closing price for the week being 60⅛—a net loss of ⅛ point. Metropolitan Street Railway fluctuated in price between 155¼ and 159¾, closing at 156¼—a net gain of 1½ points. The sales were 68,300 shares. In the electric list General Electric showed the most strength, closing with a net gain of 5 points. The week's quotations ranged between 247½ and 259¾, closing at 255. Ten thousand shares of Western Union changed hands at quotations ranging between 90 and 92¼, the closing figure being 91½—a net gain of ⅞ point. The market for outside securities at the close of the week was irregular and unsettled, and trade generally of small volume. Electric Lead Reduction was in good demand at 2⅜ and 2¼. Apache Copper sold at 52¼. Following are the closing quotations of Tuesday, Oct. 15, at New York, Boston, Philadelphia and Chicago:

NEW YORK.

| | Oct. 8. | Oct. 15. | | Oct. 8. | Oct. 15. |
|---|---|---|---|---|---|
| American Tel. & Cable... | — | — | General Carriage..... | 1 | ⅞ |
| American Dist. Tel..... | — | — | Hudson River Tel..... | 112 | 112 |
| Brooklyn Rapid Transit.. | 57⅝ | 59⅝ | Illinois Elec. Veh. Trans. | — | — |
| Commercial Cable..... | — | — | Metropolitan Street Ry.. | 158 | 158 |
| Electric Boat..... | 16 | 22 | N. E. Elec. Veh. Tran... | — | — |
| Electric Boat pfd..... | 40 | 45 | N. Y. Elec. Veh. Tran.... | 8½ | 7 |
| Electric Lead Reduc'n... | 1⅞ | 2 | N. Y. & N. J. Tel..... | 166 | 166 |
| Electric Vehicle..... | 1½ | 1¼ | Tel. & Tel. Co. of Am... | 5 | 5 |
| Electric Vehicle pfd..... | 3 | 3 | Western Union Tel.... | 90⅞ | 91½ |
| General Electric..... | 250 | 258½ | | | |

BOSTON.

| | Oct. 8. | Oct. 15. | | Oct. 8. | Oct. 15. |
|---|---|---|---|---|---|
| Am. Tel. & Tel..... | 157 | 157 | Mexican Telephone..... | 2 | 2⅜ |
| Cumberland Telephone... | — | — | New England Telephone. | — | — |
| Boston Electric Light.... | — | — | Westinghouse Elec..... | — | 71½ |
| Erie Telephone..... | 39 | 38 | Westinghouse Elec. pfd.. | — | — |
| General Electric pfd..... | — | — | | | |

PHILADELPHIA.

| | Oct. 8. | Oct. 15. | | Oct. 8. | Oct. 15. |
|---|---|---|---|---|---|
| American Railways..... | 40½ | 40½ | Phila. Traction..... | 95¾ | 95⅞ |
| Electric Storage Battery.. | 63 | 64 | Philadelphia Electric..... | 5¼ | 5¼ |
| Elec. Storage Batt'y pfd.. | 63 | 64 | Pa. Electric Vehicle..... | ½ | ½ |
| Elec. Co. of America..... | 7 | 6⅞ | Pa. Elec. Veh. pfd..... | ½ | ½ |

CHICAGO.

| | Oct. 8. | Oct. 15. | | Oct. 8. | Oct. 15. |
|---|---|---|---|---|---|
| Central Union Telephone. | — | — | National Carbon pfd..... | 83 | 83 |
| Chicago Edison..... | 160 | 160 | Northwest Elev. com..... | 38 | 40 |
| Chicago City Ry..... | 202 | 201 | Union Traction..... | 17 | 17⅝ |
| Chicago Telep. Co..... | 254* | 225 | Union Traction pfd..... | 58 | 58 |
| National Carbon..... | 18⅜ | 18 | | | |

*Asked.

NEW YORK & STAMFORD STREET RAILWAY.—Messrs. E. H. Gay & Co., Boston, are offering investors $350,000 New York & Stamford Railway Company's first mortgage 5 per cent 30-year gold bonds at 111½ and interest, at which price they net over 4.30 per cent. The railway consists of about 15 miles of track. There is $450,000 capital stock, and $450,000 first mortgage bonds, $100,000 of which are held in escrow by the trustee to be issued for additions to the property. The combined earnings of the Port Chester and Larchmont roads for the year ending July 1, 1901, were $82,168; operating expenses $51,472, leaving a net of $30,696. The earnings for July and August, 1901, were $31,400, an increase of 68½ per cent as compared with same months last year. The company operates through and from Port Chester, Westchester County, N. Y., through Rye, Harrison, Mamaroneck and Larchmont to New Rochelle, where it connects with the Third Avenue surface line of New York City. At Rye the road connects with a line to Rye Beach. The Greenwich Tramway Company, now in process of construction, and which runs from Greenwich to Stamford, in the State of Connecticut, will, when finished, connect with the New York & Stamford Railway, making a through electric railway line from New York to Boston.

WESTERN UNION ANNUAL MEETING.—The annual meeting of the Western Union Telegraph Company was held in New York on Oct. 9. The report for the fiscal year ended June 30 last, shows the following results:

| | 1901. | 1900. | Changes. |
|---|---|---|---|
| Revenues ..... | $26,354,151 | $24,758,569 | Inc. $1,595,582 |
| Expenses ..... | 19,668,902 | 18,593,206 | Inc. 1,075,696 |
| Profits ..... | $6,685,249 | $6,165,363 | Inc. $519,886 |
| Int. on bonds ..... | 956,160 | *906,102 | Inc. 50,058 |
| Balance ..... | $5,729,089 | $5,259,261 | Inc. $469,828 |
| Dividends ..... | 4,868,008 | 4,867,984 | Inc. 24 |
| Surplus ..... | $861,081 | $391,277 | Inc. $469,804 |
| Previous surplus.... | 8,458,205 | 8,066,928 | Inc. 391,277 |
| Total surplus .... | $9,319,286 | $8,458,205 | Inc. $861,081 |

*Includes $9,797 sinking funds.

EXPENSES.

| | 1901. | 1900. | Changes. |
|---|---|---|---|
| Operating and general. | $13,991,830 | $13,220,009 | Inc. $771,821 |
| Rent., leas., lines..... | 1,569,640 | 1,566,705 | Inc. 2,935 |
| Maint, and recon..... | 3,270,425 | 2,959,998 | Inc. 310,427 |
| Taxes ..... | 520,155 | 529,469 | Dec. 9,314 |
| Equip offices and wires | 316,852 | 317,025 | Dec. 173 |
| Total ..... | $19,668,902 | $18,593,206 | Inc $1,075,696 |

GROWTH OF THE COMPANY.

| | 1901. | 1900. | 1891. |
|---|---|---|---|
| Miles p'l's and c'bs.... | 193,589 | 192,705 | 187,981 |
| Miles wire ..... | 972,766 | 933,153 | 715,591 |
| Offices ..... | 23,238 | 22,900 | 20,098 |
| Messages ..... | 65,657,049 | 63,167,783 | 59,148,343 |
| Receipts ..... | $26,354,151.00 | $24,758,569.00 | $23,034,326.00 |
| Expenses ..... | 19,668,902.00 | 18,593,206.00 | 16,428,742.00 |
| Profits ..... | 6,685,249.00 | 6,165,363.00 | 6,605,584.00 |
| Average toll per mes.. | 30.9 | 30.8 | 32.5 |
| Average cost to com.. | 25.1 | 25.1 | 23.2 |

Of the increase in the total revenues for the year, $885,503 came from regular commercial messages, press dispatches and election returns, $363,072 from leased wires and $347,006 from sundry other sources.

INDEPENDENT TELEPHONY.—The reorganization of the directory of the Telephone, Telegraph & Cable Company is now in progress. It is understood that the board of directors will be reduced from 21 to 9. John B. Staffer has resigned as treasurer. Of the four Telephone, Telegraph & Cable Company representatives on the board of the Erie Telephone & Telegraph Company, three will resign, Mr. F. A. Cutting remaining. Mr. Morse will nominate three directors to represent his interests. Three strong Boston financiers have been mentioned. With regard to the situation, the chief owner of the property, Mr. Chas. W. Morse says: "I wish to say once for all, so that the matter may rest, that the Telephone, Telegraph & Cable Company of America has but one object, and that is to compete with the Bell. The system will be built up in all sections of the country, and in a few years it will be able to give a service that will meet every demand. All of the independent lines will be merged, and new communications established. The company is in the field to stay, and will naturally push forward."

ELECTRIC LIGHTING IN BOSTON.—The stockholders of the Edison Electric Illuminating Company, of Boston, at annual meeting last week voted to issue $750,000 additional stock. The board of directors was increased from 9 to 12 members. The following directors were elected: C. W. Amory, Robert Bacon, E. Henry Barnes, Walter C. Baylies, Isaac T. Burr, Everett W. Burdett, Henry B. Cabot, T. Jefferson Coolidge, Jr., George Dexter, Charles L. Edgar, Edward B. Maltby, C. Minot Weld. The directors elected the following officers: President, C. L. Edgar; vice-president, Walter C. Baylies; treasurer, Henry B. Cabot. The directors of the Boston Electric Light Company at a meeting last week also elected C. L. Edgar president, Edward B. Maltby vice-president and Henry B. Cabot treasurer, and the merger of Edison and Brush interests in Boston may now be deemed complete.

DIVIDEND.—The Edison Electric Illuminating Company, of Boston, has declared a regular quarterly dividend of 2½ per cent, payable Nov. 1.

CONNECTICUT RAILWAY & LIGHTING.—The committee on stock list of the New York Stock Exchange has recommended that $8,355,000 of the $15,000,000 first and refunding mortgage 4½ per cent 50-year gold coupon bonds of 1951 be admitted to the Stock Exchange list. With its application to the Stock Exchange, the Connecticut Railway & Lighting Company, submits the following statement, for the eight months ended Aug. 31, 1901:

| | Railway. | El. sys. | Gas sys. | Total. |
|---|---|---|---|---|
| Gross | $718,961 | $199,644 | $114,509 | $1,033,114 |
| Expenses | 435,272 | 144,232 | 84,500 | 664,004 |
| Net | $283,688 | $55,412 | $30,009 | $369,108 |
| Interest charges | | | | 284,323 |
| Net profits | | | | $84,785 |

OTIS ELEVATOR.—President Baldwin, of the Otis Elevator Company, made last week the following statement: "The business of the company is very satisfactory; our sales for the eight months of the year are about a million dollars in excess of last year's business, and a million and a half dollars in excess of 1899. The earnings for the past eight months are sufficient to pay the dividend on the perferred stock for the year, and leave a handsome surplus. At the meeting of the board of directors the matter of a dividend on the common stock was informally discussed, but no definite action was taken in view of the large expenditures necessary to provide for the rapidly increasing business of the company."

THE SOUTHERN NEW ENGLAND TELEPHONE COMPANY will increase its capital stock $230,000, raising its total of outstanding capital stock to $2,990,000. The new stock will be issued at par, and will participate in the next July dividend. The money is to be used in liquidating the floating debt incurred by the extension of the plant.

# Commercial Intelligence.

THE WEEK IN TRADE.—The general demand for merchandise was somewhat quieter, due partially to weather conditions. Bank clearings showed a further shrinkage, but are still far in advance of earlier years, and railroad earnings, though showing slightly smaller gains than of late note a continued and practical gain over previous years. In general, industrial activity continues. The iron and steel and other industries are working at full speed, and textile industries are likewise fully occupied. The demand for iron and steel continues active, particularly for the cruder forms. The exigencies of the demand for some products are illustrated by the fact that $28 per ton has been offered for steel billets at Pittsburg for immediate delivery, but not accepted, although the nominal price is but $26, at which price future orders are being booked. Heavy sales of steel rails for 1902 delivery are reported at the West. Special activity in lead and zinc is noted at Western primary points. Copper is in hand-to-mouth demand here, but spot prices have advanced in Montana. As Lake copper is mostly engaged from the larger producers, consumers needing prompt delivery are forced to pay the price asked, which is 16½ to 17 cents. With electrolytic copper it is different. Some producers are asking 16⅝ cents, while others are selling at lower prices. The standard casting brands are held at 16⅝ cents, but other brands are to be obtained at lower figures, in some instances as low as 15⅝ cents. The September railroad gross earnings are not quite so good as those for the two preceding months, but the showing made by 100 roads is of a very favorable character, exhibiting a gain of 10½ per cent in favor of September this year as compared with the same month last year. Heavy gains are reported by the Pacific roads and the granger lines, being 20.2 and 15.2 per cent, respectively, while the Southwestern carriers show an advance of 12.7 per cent, the trunk lines 9.8 per cent, Central Western 8.9 and the Southern roads 4.5 per cent. The failures for the week, as reported by *Bradstreet's*, aggregated 183, as against 175 the week previous, and 210 the same week last year.

AMERICAN BICYCLE COMPANY.—The annual report shows net profit for year of $850,682, against $855,579 for ten months of previous year. The following directions have been elected to the American Bicycle board for three years: H. A. Losher, A. Featherstone, William Barbour, J. E. Bromley, O. Unzicker. President Coleman says: "The automobile department has been gradually developing, and is now on a profit paying basis. Our policy was not to offer vehicles for sale until we could produce them as good or better than others. At Toledo, Ohio, we have the largest and finest automobile factory in the world at which is manufactured our steam automobile, the 'Toledo,' the most perfect self-propelled vehicle of its type. The Automobile & Cycle Parts Company organized and taking in all our six parts factories in January last, is proving a success, and is already upon a dividend-paying basis. The National Battery Company, owning the Sperry battery, has more orders and contracts on its books than it can fill in the next six months. The American Wood Rim Company, to which we sold our wood rim plant at Plymouth, Ind., and in which we are stockholders, is in a flourishing condition, and paid on the past year's business a dividend of 10 per cent. The Auto-Street Sweeper Company, in which we own a controlling interest, is a new enterprise, and promises to be a profitable one. Several of the fatcories discontinued as bicycle factories, have been utilized for the manufacture of automobiles and batteries; the balance have been sold or rented so that at the persent time we have but one factory that is standing unoccupied and idle."

EXPORTS OF ELECTRICAL MATERIAL AND MACHINERY.—The following are the exports of electrical material, machinery, etc., from the port of New York for the week ended Oct. 9: Antwerp—18 cases electrical material, $689. Athens—1 case, $100. Argentine Republic—38 cases, $245. Alexandria—5 cases, $120. Azores—2 packages, $109. Bilboa—1 case, $50. British Australia—54 cases, $1,292. British West Indies—18 packages, $479. Brazil—224 packages, $16,272. Chili—23 packages, $1,255. Christiania—1 package, $33. Constantinople—1 package, $50. Cuba—113 cases, $3,649. Glasgow—1 package, $11. Havre—18 cases, $650. Hamburg—105 cases, $5,901. Liverpool—43 cases machinery, $1,289; 82 cases material, $2,320. Leeds—1 case, $44. London—137 packages machinery, $21,041. Manchester—122 packages machinery, $22,317; 1 package material, $24. Marseilles—1 package, $250; 3 packages machinery, $1,200. Mexico—64 packages, $7,299; 7 packages machinery, $1,519. Newcastle—21 packages machinery, $5,300. Newfoundland—43 packages machinery, $1,268; 2 packages railway material, $854. Nova Scotia—31 packages, $439. Naples—9 packages, $600. Peru—43 packages electrical material, $1,637. Rotterdam—3 cases, $110. Southampton—18 packages machinery, $2,012. Trieste—5 cases machinery $340.

THE WISCONSIN RIVER PULP & PAPER COMPANY, of Stevens Point, Wis., has recently installed three pairs of 36-inch McCormick turbines built by S. Morgan Smith Company, York, Pa. Each pair is mounted on a cast iron draft chest in a steel flume and develops 350 horse-power, with 200 revolutions, under a working head of 18 ft. In fact, the Smith Company claims to build the highest speed cylinder gate turbines now in use. It also furnished the International Paper Company three pairs 39-inch and one pair of 36-inch McCormick turbines mounted in a similar manner, which when tested at Holyoke gave 85 per cent efficiency and extraordinary speed. These wheels are developing 7200 horse-power under 50 ft. head, and are used for operating pulp grinders at Rumford Falls, Me.

BALL ENGINE ORDERS AND INSTALLATIONS.—The Ball Engine Company, Erie, Pa., has recently furnished the Providencetown, Mass., Electric Light Company with an engine. The Ball Engine Company has also recently furnished an 80-hp engine, arranged for direct connection to generator, to the Omaha High School. The Sweet Home Plantation, Assumption Parish, La., is to have its own electric plant. The engine was built by the Ball Engine Company. Two engines, each arranged for direct connection to generators, have been recently installed in the New York Infant Asylum by the Ball people.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, Chicago, reports a shipment of 37 switchboards for the last week in September and first week in October, 13 of which were magneto and the remainder 24 common battery boards. The shipment for Saturday, Oct. 5, alone was eight switchboards, five of which were magneto and three common battery. Such figures give a vivid idea of the great activity in the telephone field.

MENOMINEE ELECTRIC MANUFACTURING COMPANY.—Mr. R. E. Jennings, president of the Menominee Electric Manufacturing Company, was a visitor in New York City during the past week and stated while here that the company is preparing to place upon the market a fan motor of attractive design for desk or bracket use.

CHICAGO OFFICE FOR THE S. K. C. SYSTEM.—Mr. John H. Finney, late of Washington, D. C., has been appointed the Western sales manager of the Stanley Electric Manufacturing Company, with offices in the Monadnock Block, Chicago. Mr. V. W. Bergenthal, formerly of Pittsfield, will be engineer of the Western sales office.

MONTAUK FIRE-DETECTING WIRE COMPANY, of 100 Broadway, New York City, has just completed a fine installation of its wire in the Manhattan Theatre, Thirty-third Street and Broadway. This wire, it will be remembered, gives an instantaneous automatic electric alarm upon the slightest heating in its vicinity, and its value is evident at a glance.

JANDUS AND BUCKEYE COMPANIES.—The two above-named companies have located their New York office at 115 Broadway, and have placed in charge Mr. Arthur Organ, who for some few years past has been stationed by them in Philadelphia. He will not only handle the Jandus enclosed arcs and Buckeye incandescents, but will supply inner globes for all makes of enclosed arc lamps.

SOUTH AMERICAN TRADE.—The recent departure from Washington of the special train carrying the United States and numerous other delegates to the approaching Pan-American Conference to be held at the City of Mexico lends especial interest to some figures on the commerce of the United States with the territory at the South, which the Treasury Bureau of Statistics has compiled for the convenience of the United States members of that Congress. The importance of development of our commerce in this particular direction is pointed out by this publication, which proves that our exports have shown less growth to the countries of Central and South America than to any other parts of the world. The commerce of the United States with the American countries lying south of her borders, it points out, has long been an object of solicitude to her statesmen, economists and business men. With the English-speaking people of American territory lying upon the north her commercial relations have rapidly grown and proven mutually satisfactory. With those of another language, occupying the contiguous territory at the South the growth has been slower and less satisfactory, and as the distance increases the growth decreases. To British North America the United States supplies 52 per cent of the total imports for consumption; to Mexico, equally adjacent, but speaking another language than our own, 40 per cent; to the Central American States, next removed by distance, though readily reached by water and now being tapped by railways, 35 per cent; to Colombia, a trifle farther removed, but equally accessible by direct water communication, 33 per cent; to Venezuela, equally accessible, 27 per cent; to the West Indies, which lie in close proximity, but which have been up to the present time controlled by commercial nations whose policy in many cases has been to retain their commerce for their own people, 20 per cent; to the Guianas, also readily reached by water, 25 per cent of the imports of British Guiana, 17 per cent of those of Dutch Guiana, and but less than 6 per cent of those of French Guiana.

NEW ELECTRIC TRACTION SYSTEM FOR TRINIDAD.—The Trinidad Electric Company, Limited, has just been organized by a group of prominent American and Canadian capitalists for the purpose of acquiring the Trinidad Electric Light Company and the Belmont Tramways, now operating in Port of Spain, Trinidad, British West Indies. The capital of the concern is $1,500,000. The American portion of the capital comes chiefly from New York, F. S. Pearson, consulting engineer of the Metropolitan Street Railway, being primarily interested in the enterprise. B. F. Pearson, of Halifax, Nova Scotia, is also understood to have a considerable interest in the company. Sir William Van Horne, formerly president of the Canadian Pacific Railway, is also a heavy stockholder. The company proposes to convert the Belmont Tramways, which are operated partly by mules and partly by narrow-gauge electric lines—about 12 miles in all—into a broad-gauge electric traction system, and to extend the road for a distance of about 18 miles, which will make a total of 30 miles of line when the projected work is completed. T. W. Teele, formerly of the Boston Elevated Railway, has been appointed manager of the Trinidad Company. He is now in Port of Spain for the purpose of determining as to the exact requirements of the company in the way of material, equipment, etc. Everything will be purchased in the United States. It is expected that the initial equipment of the road will result in an expenditure of at least $1,000,000. Mr. Teele will, according to present arrangements, return to New York inside of three weeks, when it is anticipated contracts will be given out. Mr. W. E. Plummer, whose office is in the Cable Building, 621 Broadway, has been appointed purchasing agent of the Trinidad Company.

VARIOUS FOREIGN AND DOMESTIC ORDERS FOR CRANE PIPING, ETC.—The Crane Company, of Chicago, has recently secured a contract calling for the shipment of some $20,000 worth of pipe, etc., for use in the Russian Government mines in Siberia. The pipe varies from 4 inches to 24 inches in diameter. The company is also turning out a $10,000 lot of pipe, valves and fittings, which will be installed in an electrical plant at Lima, Peru, the entire contract for the equipment of which has been allotted to the General Electric Company. Domestic contracts secured within the last week comprise orders from the Harrisburg Traction Company, the Cincinnati Electric Traction Company, the Boston Elevated Railroad Company, the Houston (Texas) Street Railway Company and the Pennsylvania Traction Company. These orders call for an aggregate of about $80,000 worth of pipe, valves and fittings to be installed in new plants.

CONTRACTS FOR EXTENSION OF MEXICO TRAMWAYS.—Mr. A. E. Worswick, resident manager of the Compania Limitada Tranvias de Mexicana, of the City of Mexico, has left New York *en route* for the Mexican capital. While here he placed some substantail orders for equipment necessary for an extension of the system to Toluca, a suburb about 11 miles distant from the city. The St. Louis Car Company secured a contract for cars, which are to have trucks manufactured by the J. G. Brill Company, of Philadelphia, and motor equipments built by the General Electric Company. The Morris Electric Company, of 15 Cortlandt Street, is reported to have been allotted an order for various supplies representing an aggregate value not far short of $50,000.

GOOD OPENING FOR MACHINERY IN SPAIN.—Mr. Carlos Yensen, of Bilboa, is at present inquiring here for large quantities of electrical machinery for the Spanish market. There is said to be a rapidly increasing demand for such apparatus of American manufacture in the Bilboa district, owing to the mining activity there. Within the last two months over $15,000,000 is said to have been invested for the development of various Bilboa mines. Mr. Yensen's firm, with a view to facilitate the handling of the large business in American machinery which is anticipated in the immediate future, is being converted into a joint stock company with a capital of some $1,500,000. Mr. Yensen, who was until recently United States Consular agent at Bilboa, will be managing director.

BIG BRITISH PRINTING PLANT.—Messrs. J. Upcott Gill and Alfred Bradley, who are associated together in the operation of the London & Country Printing Works, Drury Lane, London, W. C., are now in the United States for the purpose of placing contracts for American equipment to be installed in a new plant to be built on the other side by them. The projected works will, it is claimed, be the largest of their description in Great Britain, if not in Europe. Electricity will be exclusively used to operate the various machinery. Messrs. Gill and Bradley will visit Cleveland, Pittsburg, Chicago, Cincinnati and other machinery centers. They expect to return to New York early next week. Mr. Gill is the publisher of *The Bazaar, Exchange and Mart*, and various other periodicals.

MORE ELECTRICAL EQUIPMENT FOR VANCOUVER.—Mr. J. Keith Fisher, of the Pacific Coast Portland Cement Company, which, it will be recalled, is about to erect a large plant at Vancouver, B. C., for the manufacture of Portland cement, is due to arrive from Europe Oct. 23, when further orders relating to the electric equipment of the projected works will be determined on. It was stated Monday that the plant called for in the original plans will be considerably enlarged, and that fully $50,000 more will be expended in electrical machinery. The Bullock Electric Manufacturing Company, as already stated by us, have secured a contract for some $90,000 worth of generators and motors.

PROJECTED MERIDA-PROGRESO ELECTRIC ROAD.—Vales Castillo, the Merida banker, who is primarily interested in the scheme for building a 25-mile electric road between the Yucatan capital and Progreso, its flourishing seaport, has arrived from Europe, and is expected to make arrangements while here for the placing of contracts for material, equipment, etc., for the construction of that system. Mr. Castillo is staying at the Hotel Jefferson, East Fifteenth Street. He may also be reached through Felipe G. Canton, Columbia Building, 29 Broadway.

THE MANHATTAN RAILWAY COMPANY, of New York City, has awarded a contract to the Siegrist Lubricator Company, of St. Louis, Mo., to install its system of automatic lubrication for the entire power plant of 96,000 horse-power. The Siegrist system is also being installed in the De Beers Consolidated Diamond Mines Company, of Kimberly, South Africa, and the Glasgow Tramways Company, of Glasgow, Scotland, the largest plant in Great Britain.

BRILL SPECIALTIES FOR FRANCE AND ENGLAND.—The J. G. Brill Company, of Philadelphia, is about to make shipment of car wheels to the French Thomson-Houston Company for use on the Lyons Tramways. A quantity of Eureka maximum traction trucks are also about to go forward to G. F. Milnes & Co., the British car builders.

WESTINGHOUSE IN RUSSIA.—The Westinghouse interests, it is stated on good authority, are considering the advisability of erecting extensive works in St. Petersburg, with a view to the manufacturing of various electrical equipment for the Russian market.

PUMP EQUIPMENTS FOR CHINA.—The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, has secured a contract calling for a shipment of 15 pumping engine equipments for various uses in China. The order came through Reuter, Brockelman & Co., of Shanghai, China.

THE SPRAGUE ELECTRIC COMPANY recently held its annual meeting and re-elected the following officers for the ensuing year: John Markle, president; Edward C. Platt, first vice-president; Allan C. Bakewell, second vice-president; Harry R. Swartz, secretary and treasurer.

STILWELL FEED WATER HEATERS and purifiers have recently been supplied by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, to the Austin Rapid Transit Company, Austin, Texas; Kankakee, Ill., Electric Railway Company, and the Boonville, Ind., Electric Light & Power Company.

MUNICIPAL PLANT WANTED.—The village of Bradner, Ohio, is going to install a municipal electric light plant to cost $13,500. Mr. E. Y. Dow, of Toledo, Ohio, is the engineer. The clerk of the village is Mr. Henry Ahlf.

THE TOKIO ELECTRIC RAILWAY COMPANY is the title of a concern now being organized in Japan for the purpose of constructing and operating an electric traction system, which will be built in the various important thoroughfares of the Japanese capital.

# General News.

## THE TELEPHONE.

COURTLAND, ALA.—An effort is being made to establish a telephone exchange at Courtland. Many of the large planters who live in this town and have plantations in the adjoining country, desire this method of communicating with their plantations.

KISSIMMEE CITY, FLA.—The Kissimmee Telephone Company has let the contract for the construction of its plant.

DUBLIN, GA.—A. I. Smith has been granted a franchise to establish a telephone exchange.

ATLANTA, GA.—The Southern Bell Telephone & Telegraph Company will erect a $30,000 addition to its building.

SAYBROOK, ILL.—A new telephone line is being built southwest of town.

LIBERTY, ILL.—The Industry Rural telephone line is now being extended from here to Augusta.

WENONA, ILL., is to have another telephone exchange put in by the Wenona Union Telephone Company.

BEASON, ILL.—The farmers south of town are building a telephone line from here through the Harmony neighborhood.

SPRINGFIELD, ILL.—The Lewiston Automatic Telephone Company, Lewiston, capital $2,000, has been incorporated by George F. Loar, Ralph Hanson and Lucien Gray.

PAXTON, ILL.—The Central Telephone & Telegraph Company has been incorporated; capital stock, $30,000. C. H. Langford, H. B. Henderson and W. B. Henderson are the incorporators.

ALTON, ILL.—The Kinloch Telephone Company has been allowed to resume work on its system in Alton, with the understanding that nothing will be done at the points where trouble arose over the setting of poles.

NEW CASTLE, IND.—The New Castle Telephone Company has been incorporated; capital stock, $30,000. The directors are William O. Mathews, Lewis Sands and W. S. Bowler.

LOGANSPORT, IND.—The Logansport Home Telephone Company has been incorporated; capital, $150,000. Directors: M. A. Jordan, Walter D. Uhl, M. B. Lairy, Sol. D. Brandt and J. F. Digan.

MARION, IND.—The City Council of Marion has granted permission to the United Telephone Company to remove its overhead wires in this city and place its wires underground. The central energy system will be adopted.

MUNCIE, IND.—The telephone war between the Central Union and the independent company that is seeking entrance to the city has become lively. Both companies are actively canvassing the city with petitions. On one petition appear the names of those who are opposed to a new telephone company, and on the other the list of those who favor its entrance.

NORTH MANCHESTER, IND.—The Eel River Telephone Company, the newly organized concern at Rochester, has awarded contracts for an up-to-date local exchange. The company will build toll lines to all surrounding towns.

INDIANAPOLIS, IND.—The Luce & Ohio Township Telephone Company has decided to issue new capital stock to the amount of $8,850, the proceeds of which will be employed in making extensions and betterments of the company's service.

INDIANAPOLIS, IND.—The Cass County Telephone Construction Company has been incorporated; capital, $60,000. Wm. J. Vesey, Charles A. Wilding, A. S. Coverdalem, S. M. Foster, Geo. W. Seybold, J. G. Powell, M. F. Mahoney and J. H. Foley are the incorporators.

LOGANSPORT, IND.—The Logansport Home Telephone Company, recently granted a franchise in this city, has begun the construction of an extensive modern plant. The contract was let to the Cass County Telephone Construction Company, and the work will be pushed to rapid completion.

ELKHART, IND.—The county officers have gone back to primitive methods of communication. None of the county offices is now to be reached by telephone; the twelve telephones that were in use, having been taken out because the County Council refused to make an appropriation to pay the rents, aggregating $24 a month.

INDIANAPOLIS, IND.—The City Suburban Telegraph Association of Ohio, with a total capital of $3,465,000, of which $13,430 is represented in this State, complied with the foreign incorporation law by filing articles of incorporation with the Secretary of State and designating E. W. Swarthout, of Aurora, Ind., as resident agent.

WEISER, IDAHO.—The Council has notified the Idaho Independent Telephone Company to begin operations here within 60 days, as provided by the franchise.

CENTERVILLE, IA.—The Centerville Telephone Company is putting in a local exchange at Mystic.

REDDING, IA.—The Farmers & Merchants' Mutual Telephone Company has been incorporated; capital stock, $2,000.

SHENANDOAH, IOWA.—A new rural telephone line is now being built from Clarinda to Page Center, and it will be extended from there to Yorktown.

ALBIA, IOWA.—The Albia Telephone Company has been incorporated; capital stock, $26,000. O. M. King, J. C. Robeson, J. S. Moon and G. M. Reiseman are the managers.

IOWA FALLS, IA.—Steps were taken looking to the organization of another rural telephone company to run a line southeast from this city to Eagle City and thence to Owasa in the center of the county.

FRANKFORT, KY.—The Jessamine Home Telephone Company has increased its capital stock from $10,000 to $30,000.

FREDERICK, MD.—The Chesapeake & Potomac Telephone Company is building a new line to Jefferson, Petersville and Brunswick, this county.

SPRINGFIELD, MASS.—Following a recent reduction in service charges, both local and long distance, the New England Telephone & Telegraph Company announces that it will install free residence telephones in the Springfield district through September and October for trial, without charge until Jan. 1.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company has assumed possession of the Calhoun Telephone Company's plant at Battle Creek. Charles F. Rood, E. B. Fisher, W. J. Stuart and C. E. Torbe have been elected directors and officers.

MOUNTAIN GROVE, MO.—The Wright County Telephone Company, of Mountain Grove, has been incorporated, with a capital stock of $2,500. The incorporators are J. H. Medley, J. F. McCourt, W. C. Dugan and others.

RALEIGH, N. C.—The long-distance line from Raleigh to Newbern, N. C., will, it is stated, be completed within a few months. The system will be controlled by the Henderson, N. C., Telephone Company.

TRENTON, N. J.—The entire system of the Inter-State Telephone Company in South Jersey is to be rebuilt.

SWEDESBORO, N. J.—The Woolwich township has given the Interstate Telephone Company permission to run its lines through the township.

FORT EDWARD, N. Y.—The Hudson River Telephone Company is rebuilding its exchanges in this village and at Glens Falls.

ALBANY, N. Y.—The Southern New York Telephone Company of Albany was incorporated on Oct. 4, with a capital of $100,000 to operate a telephone line in the lower Hudson River counties, connecting Kingston, Jersey City, New York and Poughkeepsie and places between and near by that general route. Elyria, Ohio, capitalists, who have organized many telephone companies to operate in different sections of the State, are behind this company.

ST. BERNARD, OHIO.—Work has commenced on the telephone system for this place.

BATAVIA, OHIO.—The Citizens' Telephone Company, Batavia, has been incorporated; capital stock, $50,000.

SEBRING, OHIO.—The village Council of Sebring has granted a franchise to the Central Union Telephone Company.

ASHLAND, OHIO.—Work of rebuilding the local exchange has been completed and the system is now in first class order.

MANSFIELD, OHIO.—The Mansfield office of the Central Union Telephone Company has been made the headquarters of the northern division of Ohio.

AKRON, OHIO.—The United States Telephone Company is building a direct line of four circuits from Massillon to Akron, connecting at the latter place with lines to Cleveland.

ASHTABULA, OHIO.—The Ashtabula Telephone Company has declared a semi-annual dividend of three per cent, payable Nov. 1. The affairs of the company are in excellent shape.

TORONTO, OHIO.—New switchboard, cable and other equipments are being installed by the Citizen's Telephone Company, which is building exchanges at Toronto and New Cumberland.

CINCINNATI, OHIO.—The City & Suburban Telegraph Association has petitioned the Board of Public Service for the privilege of making some extensive improvements in its overhead system.

TOLEDO, OHIO.—The Central Union Telephone Company at Toledo is installing new switchboards to accommodate 10,000 subscribers. In the future the business will be divided between branch exchanges.

CLEVELAND, OHIO.—The telegraph and telephone officials of the companies in this city will confer with the city officials this week to discuss measures for placing underground all wires in the downtown section.

JEFFERSON, OHIO.—The Central Union Telephone Company is extending its service into the rural district in the vicinity of Ashtabula. A number of telephones have recently been installed in neighboring towns.

ELYRIA, OHIO.—The Seneca Falls Home Telephone Company has been incorporated in New York State, with $100,000 capital stock. Addison E. Lord, F. H. Sudro, and J. A. Make, of Elyria, Ohio, are directors in the new company.

CINCINNATI, OHIO.—A syndicate is talked of for this city, whose business it shall be to organize and conduct a company for the transmission of news by telephone to subscribers throughout the city. The afternoon papers will oppose the plan.

CLEVELAND, OHIO.—The Northwestern Telephone Company, of Aurora, Ill., in which a number of Cleveland people are interested, has declared a quarterly dividend of one per cent. The company will make numerous extensions throughout Whiteside county.

CLEVELAND, OHIO.—The Cleveland Telephone Company (Bell) is installing apparatus in a new exchange recently completed on Cheshire Street. It is stated that the company is doing an excellent business and is installing an average of twelve telephones per day.

PORTSMOUTH, OHIO.—The United States Telephone Company (long distance) is pushing construction work on a line from Portsmouth extending up the Ohio Valley to Gallipolis. It connects the exchanges at Ironton, and a number of small towns, and crosses over to Huntington, W. Va.

LIMA, OHIO.—The cutting over of the new system of the new Lima Telephone & Telegraph Company, which has succeeded the Lima Telephone Company, is now going on and the next few weeks will see 1200 telephones in operation in this county. The old independent company or the Bell Company never had over 700 telephones.

MANSFIELD, OHIO.—The Mansfield Telephone Company is making rapid strides in the remodeling of its exchange building and the installation of the new boards will soon be completed. This exchange will be one of the finest in Ohio. It will have 1200 lines in the city and will give connection to about 600 subscribers on farm lines and in sub-exchanges at Belleville, Butler, Lexington and other hamlets.

BOWLING GREEN, OHIO.—The Wood County Telephone Company has been organized, with a capital stock of $200,000. The directors are Captain L. Black, James Hickox and F. A. Baldwin, of this place; Mr. Morrison, of Bryan, and Mr. Woodbury, of Cleveland. The Bowling Green Telephone Company was absorbed by this company, which will at once extend its lines in this county. A large farmers' system is to be built.

CLEVELAND, OHIO.—President B. G. Hubbell, of the Consolidated Telephone Company, which is building exchanges in New York State, has returned from an eastern trip. He says that the entire issue of $382,000 in bonds of the Consolidated Company, which was announced a short time ago, has been taken up and the lists closed. Nearly all of the securities were taken up in cities in New York State, in which the company is locating exchanges.

CLEVELAND, OHIO.—It is stated that the Federal Telephone Company has added to its plants, exclusive of Cleveland and Columbus, new business to the amount of $39,090 during the month of August. If this increase is followed out during the year it would mean a total increase of $469,080. The prospects for the development of the various properties throughout Ohio is very flattering, and it is believed that much new business will be secured during the winter months.

CLEVELAND, OHIO.—The Federal Telephone Company held its annual meeting at East Orange, N. J., recently. The following directors were chosen: H. A. Everett, E. W. Moore, J. B. Hoge, R. A. Harmon, John Sherwin, Maxime Reber, H. D. Critchfield, J. B. Dill, Barney Mahler, C. W. Wason and J. B. Hanna. The board remains practically as before, the number of directors being increased from nine to eleven by the election of H. D. Critchfield and Maxime Reber. The officers will be chosen at a later meeting.

AKRON, OHIO.—A strike of the linemen on the Central Union and People's Telephone companies is assuming a serious aspect. The Central Union Company imported a number of men from Findlay, Mansfield and other points, but the strikers induced nearly all of them to return to their homes. Only about six linemen are at work in the city, and these are followed from place to place and in many cases their work is undone as fast as completed. A large number of telephones have been put out of service, and many connections tampered with.

CLEVELAND, OHIO.—The strike of electrical workers which started at Akron, is spreading. The trouble is pronounced among the employes of the Central Union Telephone Company, and its men are out at Akron, Fostoria, Mansfield, Tiffin, Alliance, Canton and Findlay. At Massillon the men were ordered to go to Akron to take the place of strikers, and upon their refusal they were discharged. At Findlay, employes of the Findlay Home Telephone Company went out because thirty linemen were temporarily laid off because of non-delivery of material.

CLEVELAND, OHIO.—The Inter-State Telephone Company, which is the long-distance department of the Consolidated Telephone Company, of this city, is building a through trunk line from Birmingham, N. Y., to State Line, Pa. This line touches all of the independent exchanges in southern New York State, and it will connect with the lines of the United States Telephone Company, at State Line. Work on this line is being pushed, and when completed it will form part of the chief independent trunk line, connecting the western systems with the east.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company has made a supplemental mortgage for $2,223,000 to the Dime Savings & Banking Company, as trustee, covering all the real estate, franchises, equipments and other personal property. J. B. Hoge, treasurer of the company, states that the filing of the mortgage was a mere formality made necessary through a slight change in the wording of the original mortgage, which was made about two years ago. The amount of the mortgage and the assignment and terms of the stocks and bonds of the company continue as heretofore.

CLEVELAND, OHIO.—Mark Davis, the retiring general manager of the Cuyahoga Telephone Company, was presented Friday of last week by his associates in the employ of the telephone company with a magnificent diamond stud. He formally severed his connection with the company on that day, and before leaving his office, he was asked to step into the corridor, where he was confronted with all of the employes at headquarters. Treasurer Hoge, of the company, made the presentation speech. Mr. Davis will make his headquarters in Cleveland, and will represent an insurance company.

CLEVELAND, OHIO.—President B. G. Hubbell, of the Consolidated Telephone Company, says the long-distance company is defendant in a peculiar law suit brought by the Bell Company at Courtland, N. Y. On a certain highway the independent company has right of way and built on one side of the road while the Bell Company occupied the other. Because of physical conditions it became necessary to cross to the other side of the road, and the independent company placed its poles up through the Bell lines and strung its wires above. The Bell Company asked for injunction, and the final hearing is to be heard at Courtland, Oct. 21. It is stated that this is the first case of the kind to be tried in the East. In Ohio a similar case has been settled in favor of the independent company, the court holding that it had the right to cross over.

CLEVELAND, OHIO.—A gentleman who is prominent in the independent telephone field gives information relative to the Frontier Telephone Company, which has just been incorporated in New York State. Although the company states in its charter that it will build long-distance lines to a number of leading cities in that State, it is not the intention to enter into competition with the Consolidated Telephone Company, of Cleveland, which is building extensive long-distance lines in New York, but simply to make arrangements to give long-distance connection for an exchange which the company proposes to build in Buffalo. The new company is backed by Judge Thomas, of New York, and E. C. Lufkin, of Fredonia. It proposes to give a portion of its gross receipts to the city, to furnish free city telephones, to furnish $50 business telephones and $36 residence connections, and to furnish bond not to sell out or consolidate with other companies.

COLUMBUS, OHIO.—The appraisement of the telephone properties of the State has been completed, with the exception of the Columbus Citizens', the Cleveland (Bell) and Cuyahoga, of Cleveland and the City & Suburban (Bell) of Cincinnati, which will be announced later. With these estimated Auditor Guilbert places the valuation at $8,183,775; last year it was $5,838,834; increase, $2,344,739. The appraisements on companies over $10,000 are as follows: Akron People's, $49,050; Ashtabula, $21,240; Bellefontaine, $14,000; Black River, $16,200; Bowling Green, $11,751; Bucyrus, $16,000; Cambridge Home, $12,000; Central District & Printing (Bell), $303,836; Central Union (Bell), $2,815,986; Delaware Citizens', $10,500; Washington C. H. Citizens', $12,000; Citizens' Telephone Message Company, $14,340; Clinton, $13,000; Columbiana County, $77,273; Conneaut, $12,500; Elyria, $17,875; Galion, $10,000; Gallipolis, $10,500; Tiffin Home, $12,000; Chillicothe Home, $20,145; Jefferson & Warren, $15,140; Lawrence, $13,000; Lima, $19,670; Massillon, $15,275; Miami, $24,180; Millersburg, Wooster & Orrville, $25,493; Mt. Vernon, $11,520; Newark, $11,860; New Harrison, $30,000; Northwestern, $10,000; Ohio Telephone & Telegraph (Bell) $601,809; Painesville, $10,500; Piqua Home, $31,500; Portsmouth, $18,600; Putnam, $11,440; Sandusky, $21,600; Sidney, $10,000; Steubenville, $16,000; Tuscarawas, $10,800; United States, $300,803; Urbana, $15,600; Warren & Niles, $20,300; Youngstown, $80,382.

PITTSBURG, PA.—A contract has been signed by James T. Doyle, for the Pittsburg & Allegheny Telephone Company, with the Union Telephone & Telegraph Company for an interchange of long-distance service in their respective territories. This opens up to Pittsburg and Allegheny and vicinity an immense territory not hitherto covered, direct communication being established with Erie, Meadville, New Castle, Mercer, Clarion, Franklin, Warren, Petroleum Center, Ellwood City, Sharon, Conneaut Harbor, Tionesta, Shenango, and other points.

UNION, S. C.—The Bell Telephone Company will construct a long-distance line from Spartansburg to Union, S. C.

ABERDEEN, S. D.—The Dakota Central Telephone Company has purchased the Eureka telephone exchange and the line from Eureka to Mound City.

GAINESVILLE, TEX.—The Southwestern Telephone Company will grant the request of the Red River Telephone Company and give a connection in Gainesville.

SALT LAKE CITY, UTAH.—The Never-Find Mining Company, of Deep Creek section, will equip its mine and mill with telephones. It will also install about 300 lights in its mine and mills.

SALT LAKE CITY, UTAH.—The Eureka-Nephi telephone cut-off is complete to Mona and the work on the Beaver line is being pushed west of Joseph. The material for the Milford and Frisco line has been ordered and General Manager Murray states that the line will be completed this fall. The Syracuse and Hopper line out of Ogden will be connected up by the middle of October. In Wyoming the work of construction is being pushed with vigor. The line south of Rollins to the Snake River country on the border of Colorado, which has for many years been notorious as a refuge for train robbers, has been completed to a point beyond Dickerson.

SALT LAKE CITY, UTAH.—Salt Lake will have an independent telephone system composed entirely of local business men, headed by S. F. Fenton, P. W. Madsen. The company has closed a deal by which it becomes the owner of the interest in the Salt Lake Home Telephone Company, owned by E. W. Hammer. The price paid for Mr. Hammer's interest is $5,000. Some time ago the Home Company was organized for the purpose of obtaining a franchise to put in an independent telephone system. The franchise was shelved by the City Council, and has never been acted upon. The new company, it is said by those interested, will try and obtain a franchise alike in almost all particulars to the one now with the Council. In the new franchise the company agrees to build an underground system and to put in an exchange large enough to accommodate 3000 subscribers. The city will be given 5 per cent. of the net receipts, and also thirty telephones free. The cost of all telephones in business houses will be limited to $48 per year and individual lines into private houses will cost $2.50 per month.

ST. ALBANS, VT.—The Addison County Telephone Company is extending its line to North Ferrisburg so as to make a Burlington connection.

SEATTLE, WASH.—The permit will soon be given out for the new telephone building of the Automatic Company. W. D. Kimball is the architect and Windham & Comb, the contractors. The cost is to be $30,550.

RACINE, WIS.—The Wisconsin Telephone Company has decided to extend its system as far as Franksville.

MANITOWOC, WIS.—The Green Bay & Lake Michigan Telephone Company has asked for a franchise in this city.

MILWAUKEE, WIS.—The extension and improvements of the telephone service of the Milwaukee Electric Railway & Light Company and the installation of the new Stromberg-Carlson system which have been in progress since May 1 will soon be completed. The commercial and dispatching systems are separate. The full capacity of the latter board will be 1500 outside telephones, but only 120 will be installed now. As it is, this nearly doubles the present capacity, which is 65 telephone stations. The commercial switchboard will be separate by day, but consolidated with the dispatcher's board at night, when the latter will attend to them both. The commercial board connects with the homes of employes, car barns and outside offices, and will not be enlarged for the present.

## ELECTRIC LIGHT AND POWER.

WASHINGTON, D. C.—The District Commissioners are inviting sealed proposals until Oct. 26, for the construction of a power-house and nurse's home, with stack and equipment, on the Providence Hospital Grounds in that city.

WALLACE, IDAHO.—The electric light and water power plant in Wallace, Idaho, has been acquired by Spokane men. The new company is the Wallace Light & Water Company. It was organized by Robert E. Strahorn. The officers are: F. F. Johnson, president of the First National Bank of Wallace, president of the company; Robert E. Strahorn, vice-president and manager; E. J. Dyer, president of the Exchange National Bank of Spokane, secretary and treasurer. The directors are Robert E. Strahorn, John A. Finch and R. J. Danson. Mr. Danson is the attorney.

INDIANAPOLIS, IND.—The Remey Electric Company, of Anderson, has filed articles of incorporation with the Secretary of State; capital, $10,000. B. P. Frank and I. and B. M. Remey are the promoters and officers.

ST. LOUIS, MO.—The property of the Suburban Electric Light & Power Company at Webster Grove, has been leased to the St. Louis Electric, Construction & Maintenance Company, for a term of forty-one years. The Suburban Company held the contract for lighting Webster Grove, and had, previous to last Spring, lighted Kirkwood also. Last April, however, the Kirkwood Board of Aldermen put in a plant for the municipality, though the Webster Grove Company still maintains several lighting contracts with individuals and private corporations in Kirkwood. B. F. Delafield took temporary charge of the plant last week for the new company. He stated that he would make improvements in the plant at once.

GOLDSBORO, N. C.—The Board of Aldermen of Goldsboro has decided to call an election on the question of issuing $110,000 in bonds, $25,000 of which will be for an electric light plant.

NEWBERN, N. C.—At a meeting of the City Council it was voted to discontinue the arc street lights at the expiration of the contract. It is said, however, that the company will continue to furnish light and sue for the pay. On account of alleged bad service it was decided to hold an election on the question of establishing a municipal plant, but this failed.

WADESBORO, N. C.—Samuel T. Stowe, of Charlotte, N. C., and Mr. Thurston, of Maine, have been engaged in surveying the water power at Bluitt Falls, near Wadesboro, N. C., where it is proposed to develop considerable water power. The power will be transmitted to neighboring cities. There is also some talk of constructing a street car line in Wadesboro.

COLUMBUS, OHIO.—The Indianola Electric Heating & Light Company, of Columbus, has broken ground for a new power plant. The company will furnish light and heat.

SHELBY, OHIO.—The electric light fund of this city has been overdrawn $12,000 because of the expense in operating the municipal lighting plant. The expenses each month exceed the receipts and the plant is plunging the village into heavy debt.

COSHOCTON, OHIO.—The Coshocton Electric Light Company has been granted a franchise for a steam heating system in the streets of the village. It will be operated in connection with the lighting plant, and $75,000 worth of new machinery is to be installed.

GENEVA, OHIO.—The Everett-Moore syndicate, which has bought out the plant of the Geneva Electric Light Company, is installing considerable new machinery and is purchasing a number of enclosed arc lamps for city lighting, the contract for which has recently been closed.

SALT LAKE CITY, UTAH.—A. L. Woodhouse and E. L. Lackneron petitioned the County Commissioners for a franchise to erect poles and wires and engage in the electric light and power business in West Mountain mining district. They represent that by securing arrangements with the Telluride Power Company they will be able to furnish lights and power from Provo Canyon to that district at a cheaper price than is now being charged, and with better service. Mr. Woodhouse is general superintendent and Mr. Lackneron attorney for the Utah division of the Telluride Company.

SPOKANE, WASH.—The County Commissioners have granted a franchise to the Washington Water Power Company to construct pole lines, etc., through the county.

## THE ELECTRIC RAILWAY.

ROCHESTER, IND.—The City Council has granted a franchise to the Rochester-Wabash Electric Railway Company. A franchise was also granted to the Logansport, Rochester & Northern Traction Company, granting it the right, on certain conditions, to run and operate an interurban line through Rochester. The Wabash-Rochester line is being financed by Cleveland men, and they have accepted the franchise, closed all contracts and will push work with a view of opening up a country between this city and Chicago through which no railroad operates.

INDIANAPOLIS, IND.—The managers of the steam roads admit that they have a difficult problem to solve in meeting the competition of the electric roads. The Big Four has demonstrated that it does not pay to put on additional short trains and reduce the rate and has taken off six trains on the Eastern division, where it sought to compete with the Union Traction Company. The reason assigned is that these trains interfere with the operation of the freight and fast through passenger trains. The most potent reason is that the trains did not yield revenue sufficient to justify their continuance. The Pennsylvania lines on the Columbus & Louisville division have experienced the same difficulty in their endeavor to compete with the electric lines, and are about ready to discontinue their short line trains.

BALTIMORE, MD.—The Maryland Electric Railway Company, which has a charter granted in 1898 by the Maryland General Assembly, has had an ordinance introduced in the City Council granting the new company the right to construct and use electric railway tracks on many streets. Among the inducements offered are provisions that the company shall sell tickets six for 25 cents, and that the company is to pay 9 per cent of gross receipts as a park tax. Free transfers are to be issued on all its lines and for exchange with other lines.

BENTON HARBOR, MICH.—The West Michigan Traction Company, known as the Tunnel line, has accepted the franchise recently granted by the city.

RALEIGH, N. C.—The street railway line to the Union Passenger Depot at Raleigh is being torn up. For several years no cars have been operated on this line, because receipts did not meet the cost of operating.

WILMINGTON, N. C.—The Wilmington Street Railway has been sold at auction under foreclosure to Hugh MacRae & Company, of Wilmington, for $101,500. The purchasers of this line have recently secured the controlling interest in the road to Wrightesville Beach, which will be equipped electrically, and the two operated jointly. Extensive improvements may be made.

YOUNGSTOWN, OHIO.—The East Sharon Street Railway Company has been incorporated.

LORAIN, OHIO.—The Lake Shore Electric Railway has accepted the franchise recently granted in Lorain.

CINCINNATI, OHIO.—The Cincinnati, Georgetown & Portsmouth Railroad is to be changed into an electric line.

CLEVELAND, OHIO.—The passenger receipts of the Northern Ohio Traction Company, during the month of September were $49,644.13, a gain of $10,964.59.

WARREN, OHIO.—Owing to the inability to secure teams and men the work on the extension of the Cleveland & Eastern Railway from Garrettsville to Leavittsburg is being greatly delayed.

CLEVELAND, OHIO.—The village of Collinwood has agreed to grant a franchise to the Cleveland Electric Railway Company, which will enable it to make a long contemplated extension to Nottingham.

LIMA, OHIO.—The Toledo, Columbus, Springfield & Cincinnati Railway Company has filed a mortgage for $100,000, to guarantee the construction of the section of the road between Lima and West Minister.

CANTON, OHIO.—The Everett-Moore syndicate has been balked in its attempt to secure a franchise in Canton for its proposed Akron, Massillon & Canton Railway by the action of the Council in refusing the grant.

CINCINNATI, OHIO.—Dr. Samuel F. George, president of the Fort Wayne, Dayton & Cincinnati Traction Company, is arranging for the extension of his line into Cincinnati. Dr. George is now in New York City placing the bonds.

CLEVELAND, OHIO.—Dividends were declared Oct. 5 by both the Cleveland Electric Railway Company and the Cleveland City Railway Company. The former company paid a quarterly dividend of 1 per cent and the latter of 1¼ per cent.

UPPER SANDUSKY, OHIO.—The Council at Upper Sandusky has granted franchises into town to two electric railways. One of them is the Findlay & Marion Railway and the other is the Tiffin & Southern, of which Dr. O. C. Stutz is trustee.

COLUMBUS, OHIO.—The Columbus, Grove City & Southwestern Railway Company has filed a mortgage for $250,000 to the Continental Trust Company, of New York City, covering a bond issue to that amount. The issue secures 20-year 5 per cent gold bonds.

CLEVELAND, OHIO.—The passenger receipts of the Cleveland, Elyria & Western Railway for the month of September were $27,391.66, a gain of $8,528.50 over the same period last year. The net receipts were $14,995.54, which is a large gain over last year.

CANTON, OHIO.—Work has been started at Canton on the Stark Electric Railway, which is promoted by Cleveland people. The road is practically completed from Alliance to Sebring. An extension will be built to Salem. This will give a through line from Cleveland to Salem.

COLUMBUS, OHIO.—The Board of Public Works has announced that franchises for lines through the city will be granted only to the lowest bidder. The Columbus & Southern Railway Company has just applied for a franchise and the right over the route is to be advertised for sale.

COLUMBUS, OHIO.—The Scioto Valley Traction Company has temporarily abandoned its attempt to extend its line to Chillicothe because of the difficulty in securing right of way. The Circleville and Lancaster divisions can not be completed until next spring because of delay in securing rails.

CLEVELAND, OHIO.—Manager Allen F. Edwards, of the Detroit & Toledo Shore road, states that overhead work on the line has been started. The National Conduit & Cable Company is furnishing 20 miles of cable and the American Steel & Wire Company the wire and the copper bonds.

CLEVELAND, OHIO.—The passenger receipts of the Detroit United Railways for the month of September were $275,280.40, an increase of $39,871.34. The receipts of the Rapid Railway System, which is not at present managed as a part of the Detroit system, were $41,221.60, a gain of $3,341.70.

CINCINNATI, OHIO.—The Traction Company has shipped to Tokio, Japan, a complete set of overhead double trolley crossing devices. The shipment is a direct result of a visit paid by two Japanese gentlemen—M. Euya and Y. Kasuya, electrical experts. They visited every city of importance in the United States.

GENEVA, OHIO.—The Cleveland, Painesville & Eastern Railway has purchased a site at Geneva for a power-house for the Ashtabula extension. The syndicate also has a contract to furnish electric lights in Geneva. The locating of a power-house at Geneva indicates that the road is to be extended still further East, probably to Erie, Pa.

DAYTON, OHIO.—The Dayton, Covington & Piqua Traction Company, formerly known as the Dayton & Stillwater Valley Traction Company, has increased its capital stock from $50,000 to $1,150,000, of which $550,000 is to be 5 per cent. preferred stock. Judge Dennis Dwyer is president of the company. The road is under construction.

CLEVELAND, OHIO.—The Everett-Moore syndicate is securing right of way to extend its Detroit, Rochester, Romeo & Lake Orion line, now in operation to Flint, on to Saginaw and Bay City. This will give a line almost across the southern peninsula, and will give direct connection for Detroit to 125,000 people in these towns and vicinity.

CONNEAUT, OHIO.—Officials of the Pennsylvania & Ohio Railway state that the road will be in operation between Conneaut and Ashtabula by Nov. 1. As soon as this line is in operation, a road will be built from Ashtabula south to Jefferson which will probably be extended to Andover. The new power-house in Ashtabula will supply both lines with current.

CLEVELAND, OHIO.—The Pomeroy-Mandelbaum syndicate has bought another road. This time it is the Ohio Central Traction Company, which operates a line from Bucyrus to Galion, and which has an extension to Crestline partially completed. The portion of the extension which has been completed will be utilized and the balance of the route abandoned.

FOSTORIA, OHIO.—The directors of the Toledo, Fostoria & Findlay Railway met in Fostoria, to decide on the route for the northern portion of the line to Toledo. The road will probably touch Rising Sun, Bradner and Pemberville. Construction work is to be pushed until stopped by cold weather. The road is being built by E. P. Roberts & Company, Cleveland.

CLEVELAND, OHIO.—The Pomeroy-Mandelbaum syndicate, which owns the Southern Ohio Traction Company's line, is preparing plans to consolidate that company with the Hamilton & Lindenwald Transit Company, and the Miamisburg & Germantown Traction Company. To absorb these lines it will be necessary to increase the capital stock and bonds of the Southern Ohio Company.

COLUMBUS, OHIO.—The Central Ohio Traction Company has been incorporated with $100,000 capital stock by W. F. Carr, S. H. Tolles, J. E. Morley, Reuben Hitchcock and C. H. Gale. The company proposes to build an electric line from Tiffin to Fremont.

## THE AUTOMOBILE.

THE AUTOMOBILE DEPARTMENT of the American Bicycle Company entered four vehicles in the first annual race meet of the Detroit Automobile Racing Association, held at the Grosse Pointe track, Detroit, Oct. 10, 1901. The three races in which entries were made were: 5 miles for steam carriages, 1 mile open to all vehicles weighing less than 1500 lbs., and the obstacle race. In the 5-mile event the Toledo carriage secured the second place, while the two vehicles entered in the 1 mile open divided first and second honors between them. In the obstacle race the Toledo carriage scored 100 per cent. making the total Toledo winnings for the day one first and three seconds, which was the best showing made. The day previous to the race, 5 standard Toledo carriages, which were to take part in the Automobile parade in the morning, and two of which were later in the day to participate in the race, left Toledo at half-past ten, arriving in Detroit at 1:15, making the run of 63 miles in 2¾ hours. The roads part of the way were in fairly good condition, while those encountered from Trenton on were in pretty poor shape. The 5 Toledos after arrival were washed down, and with very little attention beyond application of oil to the working parts, lined up for the parade in exactly the same condition as they left Toledo. At the close of the racing for the day, two of the carriages started on the return journey to Toledo, the other three remaining until the morning following. All five reached Toledo in perfect condition.

## NEW INDUSTRIAL COMPANIES.

THE UNITED STATES ELECTRIC CLOCK COMPANY, of New York City, has been incorporated, with a capital of $500,000. Among the directors are William M. Townsend, Joseph Delafield and Edward A. Siegel, of New York City.

THE ELECTRICAL INVESTMENT COMPANY OF INDIANA, a Ft. Wayne company, has filed articles of incorporation, with $100,000 capital stock. The company proposes to buy bonds and stocks of electric companies and assist in the financing of electric railways. All of the incorporators are Ft. Wayne men, the board of directors being headed by Louis Fox.

## OBITUARY.

MR. J. LEE JUDSON.—We regret to note the death of Mr. J. Lee Judson, of Rochester, in that city. He was born in 1847 at Cincinnati. After pursuing the manufacturing interests established by his father, he became one of the founders of the Edison Lighting Company, of Rochester, and its president. Upon the consolidation of the various lighting interests in that city, he was made president of the Rochester Gas & Electric Company, which has been very successful under his management. He was of late actively engaged in the plans to increase the supply of electric power from Genesee water storage, etc. He was prominent in the business, social and intellectual life of Rochester, and his death is deeply regretted. He leaves a widow and five children.

## EDUCATIONAL.

EVENING TRADE SCHOOLS.—The Springfield, Mass., evening school of trades is said to be the first school to be established in this country for the teaching of trades at public expense. The character of the teaching is strictly technical, and the men employed in teaching are practical mechanics of the highest order, and bring to their work an expert knowledge of the needs of the shop world. Instruction is given in machine shop practice and tool making, in joinery and pattern making, and in plumbing. In connection with these classes there are classes in mathematics for mechanics. Certificates of proficiency will be awarded to those who complete the course satisfactorily. The announcement of classes for the present season show the courses to be very practical. Residents of Springfield receive free tuition, but non-residents are required to pay a tuition fee, the term covering 21 weeks. Mr. Charles F. Warner is the principal of the Mechanic Arts High School, Springfield.

NEW YORK TRADE SCHOOL.—Beginning with Nov. 1, and every alternate Friday evening thereafter until March 14, 1902, lectures for journeymen electrical workers will be given at the New York Trade School, First Avenue, between 67th and 68th Streets, New York. The lecturer is Mr. Arthur A. Hamerschlag. The course embraces ten lectures on subjects that will be helpful to the journeyman in his daily work. Problems of common occurrence will be discussed and explained, accompanied by practical demonstrations. A course of ten lectures will also be given under the same auspices and by the same lecturer for the benefit of journeymen steam engineers. The lectures will be given every alternate Wednesday evening, beginning with Oct. 23, and ending March 5, 1902. The subjects, as outlined in the announcements of these two courses, are of the most practical kind. The object of these lectures is not to make them a financial success, but to engage and interest journeymen in new development in connection with their work.

## PERSONAL.

MR. J. M. GRAVES, of Philadelphia, has just accepted a position as electrical and mechanical engineer for the Chicago Insulated Wire Company, of Chicago.

SIR CHRISTOPHER FURNESS, the leading English shipowner, and now one of the directors of the London underground, is visiting this country studying the traction situation.

MR. C. W. MORSE, the new "independent" telephone capitalist, has also been investing heavily in New York banks, and has just secured control of the National Broadway Bank, a well known institution.

MR. H. C. ADAMS, JR., has resigned his position as secretary of the Phillips Insulated Wire Company and on Nov. 1 will assume new duties as New York manager for the Peru Electric Manufacturing Company.

MR. FRANK J. SPRAGUE contributed to the *Engineering Magazine* for October a most interesting and valuable article on the "Rapid Transit Problem in London." It has now been issued in neat pamphlet form.

MR. A. J. WURTS, of the Westinghouse Electric & Manufacturing Company, who has made the subject peculiarly his own, lectured on the Nernst lamp on Oct. 16, before the Franklin Institute, Philadelphia. The lecture was accompanied by a display of the lamps and of their constituent parts.

MR. A. H. POTT, who has been for some few months in this country representing the engineering firm of Preece & Cardew, and has been investigating electric railway practice, spent last week at the American Street Railway Convention, and then sailed for London. Mr. Pott won many friends and made many acquaintances while in this country.

PROF. S. H. SHORT, technical director, English Electric Manufacturing Company, is in this country on a brief trip, accompanied by Mrs. Short. He was a greatly interested visitor to the Street Railway Convention and a warmly welcomed guest at the annual banquet. Prof. Short reports great activity on the part of his company in the production of electric railway apparatus.

MR. L. B. STILLWELL, the well known electrical engineer, has in connection with his work for the New York Rapid Transit Subway Construction Company the official title of electrical director, as he had at the Niagara power plant. Associated with him as mechanical engineer is Mr. John Van Vleck, lately prominent on the engineering staff of the New York Edison Company.

PROF. R. A. SMART has resigned his position in the Department of Experimental Engineering of Purdue University at Lafayette, Ind., and connected himself with B. F. Sturtevant Company, of Boston, Mass., with whom he will become the head of a department of experimental engineering which is being established for the purpose of investigating all problems relating to blower practice and of developing new and more efficient applications of the fan-blower in all lines of industry.

MR. Z. S. HOLBROOK has resigned as president and director of the Massachusetts Telephone & Telegraph Company, and also as vice-president and director of the Boston & New York Telephone & Telegraph Company, in order to accept the presidency of the American Electrolytic Company. This last company has purchased of the National Salt Company its immense plant at Rock Glen, N. Y., and will at once begin the manufacture of caustic soda bleaching powder and allied products.

MR. JAMES FERGUSON, formerly general superintendent of the Municipal Electric Light Company, Brooklyn, N. Y., and later superintendent with the Edison Electric Illuminating Company, has accepted the position of general superintendent and consulting engineer of the McRoy Clay Works, of Brazil, Ind. Conduit work is at once a growing and important branch of electrical engineering, and Mr. Ferguson's new field of manufacturing and installation affords an excellent field for his experience and ability.

# Trade Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is pushing Adams-Bagnall 3½-ampere arc lamps for all circuits, to meet gas or gasolene competition.

THE ABBOTT ELECTRIC & MANUFACTURING COMPANY, of Cleveland, manufacturer of electrical specialties, will soon remove to Warren, Ohio, where the business will be expanded and new lines produced.

MACHINE TOOLS.—The line of high grade machine tools manufactured by the Springfield Machine Tool Company, Springfield, Ohio, is described and illustrated in a pamphlet just issued by this company. Specifications of the various machines are given, together with a cable code to facilitate ordering by cable or telegraph.

MILLING MACHINES.—Kempsmith millers are described and very artistically illustrated in a 56-page pamphlet issued by the Kempsmith Manufacturing Company, Milwaukee, Wis. The front cover is a very handsome example of the engraver's art.

TELPHERAGE.—Various applications of the system of the United Telpherage Company, New York, are described and illustrated in a 16-page circular just issued by the company. The advantages to be derived in the use of the system in factories are also pointed out.

REMOVAL NOTICE.—The H. P. Cameron Electrical Manufacturing Company has moved its business from Syracuse, N. Y., to Ansonia, Conn., where it will be better able to serve its customers. In addition to its business in general commutator work and supplies it is equipped with facilities to rewind armatures and execute all kinds of repairs.

I. P. FRINK, 551 Pearl Street, New York, reports a fresh importation of fine French silk and velvet flowers, used for decorative purposes on electric lamps. Mr. Frink has not been able to get any of these for some time, but now has a fine assortment on hand, in poppies, fleur de lis, and roses, in a good variety of colors—all the delicate tints of old rose, pink, yellow, lavender, red, etc.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, exclusive territorial agent for the Adams-Bagnall enclosed arc lamps, state it is meeting with great success with its constant current series enclosed lamps. This lamp has a solid copper, weather-proof case, which renders it practically impervious to all attacks of the elements. Descriptive matter, prices, etc., will be mailed on application.

A "SOLID" RECEIVER.—Wm. J. Murdock & Company, Chelsea, Mass., make telephone receivers styled "solid" receivers. The title would imply that these instruments are substantially built and made for heavy service, and it appears from a folder issued by the firm that the receivers possess these features to an eminent degree. The firm makes two styles, the Bell and the watch case, both of which are illustrated in section and perspective.

MR. A. L. DYKE, the pioneer automobile supply and parts dealer, of Linmar Building, St. Louis, informs us that his new 50-page catalogue is now ready for distribution. He regards this as the most complete catalogue which has yet been issued. It contains sectional views and illustrations of three types of gasoline machines, and two styles of steam machines, together with full description of Dyke's carburetter, coils, plugs, batteries, etc. A stamp gets one.

ENLARGING FACTORY.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., informs us that, owing to the rapid growth of its business, it has been compelled to increase its manufacturing facilities. It has added a new building to its Milwaukee factory, which gives additional floor space of 8000 square feet, making the total space of the factory about 55,000 square feet, all of which is devoted exclusively to the manufacture of rheostats and circuits breakers.

TOLEDO TELEPHONE PLANT.—We have been requested by the Sterling Electric Company, of Lafayette, Ind., to state that the entire Toledo telephone contract, as noted in our issue of Oct. 12, was awarded to it, and that no part of the contract went to the Kellogg Switchboard & Supply Company, as was stated in the earlier news items on the subject. The first and only award, President Cook says, was to the Sterling Company.

LEATHER BELTING.—A catalogue and price list of 112 pages has just been brought out by the Charles Munson Belting Company, Chicago, Ill. It contains many illustrations showing the process of belt manufacture, belt accessories, pulleys, etc., besides giving some practical hints and suggestions regarding the use of leather belts, and general tables for calculations. The catalogue is very complete, and includes copies of many testimonial letters and a long list of names of concerns using Munson belts. It also contains a concise telegraph code.

THE WAGNER ELECTRIC MANUFACTURING COMPANY has recently developed an interesting field of application for its single-phase motor generator sets in the mining industry. These sets, made up of single-phase induction motors driving compound-wound, direct-current generators, are being extensively used for supplying direct current to electric drills from high tension multiphase alternating current distribution systems. Such an equipment calls for one transformer only, stepping down from 10,000 or 20,000 to 200 volts alternating, at which pressure the single-phase induction motor operates. The equipments are compact, automatic in their operation, and thoroughly reliable.

GOLD MEDAL FOR HOLOPHANE.—In the list of Pan-American awards printed in this issue is note of a gold medal to the Holophane Glass Company. The "Holophane" globes are attracting universal attention and elicit high encomiums. They were awarded the John Scott medal by the Franklin Institute "for giving much better diffusion and more satisfactory distribution than any other globes known," and at Paris, two gold medals were secured for scientific accuracy of calculations and excellency of workmanship and quality of glass," as well as "the best light diffusing and [illegible] for electricity and gas." At that Exposition they also secured a silver medal for valuable improvements in lighting appliances."

CABLE TESTING APPARATUS FOR TELEPHONE COMPANIES.—The larger telephone companies recognize the fact more fully than ever before that it is necessary to make frequent tests of insulation and capacity to determine whether their cable systems are in proper condition. Morris E. Leeds & Company, of Philadelphia, working in conjunction with Mr. Henry W. Fisher, of the Standard Underground Cable Company, Pittsburg, have brought out a series of cable testing outfits that have been most highly prized by such telephone engineers as have had opportunity to use them. Not only the independent telephone companies are installing these outfits, but some of the big Bell subcompanies have made similar investments. Recently Mr. James G. Biddle, of Philadelphia, who is sole selling agent for Morris E. Leeds & Company, took important orders for cable testing equipments from the Keystone Telephone Company, Philadelphia, and the Interstate Telephone Company, Trenton, N. J. The apparatus purchased by these companies is fully described in special Catalogue 360, which can be obtained without charge by addressing Mr. Biddle.

# Record of Electrical Patents

UNITED STATES PATENTS, ISSUED OCT. 8, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

683,515. CONDUCTOR CLEANER AND CARRIER; A. H. Stewart, Nashville, Tenn. App. filed July 3, 1901. A device for removing material from overhead conductors consisting of a carriage adapted to travel on the conductor and carry a torch and a knife. (Issued Oct. 1.)

683,924. ELECTRIC ELEVATOR SYSTEM; E. M. Fraser, San Francisco, Calif. App. filed July 20, 1899. Two motors are connected with the car in such a way that when they are both running at same speed, the car will remain stationary. The speed of either motor is altered from the car by short-circuiting the current through a portion of the field to cause the car to travel either up or down.

683,927. TROLLEY SWITCHING DEVICE; F. W. Garrett, Johnstown, Pa. App. filed Dec. 3, 1900. The trolley pole is swung laterally slightly by the motorman, to cause the wheel to move from one rib to the other of a switch.

683,936. MOTOR CONSTRUCTION; G. H. Hill, Glenridge, N. J. App. filed Aug. 5, 1901. The bolts securing the field coil between the arms of the yoke pass through open slots in the end of the yoke, so that the coil can be removed without entirely withdrawing the bolts.

683,952. TELEPHONE TRANSFORMER; H. Liebreich, Detroit, Mich. App. filed Nov. 30, 1900. (See page 646.)

683,953. TELEPHONE TRANSFORMER; H. Liebreich, Detroit, Mich. App. filed Nov. 30, 1900. (See page 646.)

683,954. TELEPHONE TRANSFORMER; H. Liebreich, Detroit, Mich. App. filed Nov. 30, 1900. (See page 646.)

683,962. METHOD OF MAKING CALCIUM CARBID; H. Maxim, New York, N. Y. App. filed Jan. 25, 1895. (See page 647.)

683,969. TELEPHONE EXCHANGE SYSTEM; W. E. McCormick, Chicago, Ill. App. filed Dec. 6, 1899. (See page 646.)

683,982. INCANDESCENT LAMP ATTACHMENT; G. D. Pogue, St. Louis, Mo. App. filed April 29, 1901. A dimming attachment comprising an artificial resistance which is operated by the act of screwing the lamp into the socket to a greater or less extent.

684,007. CIRCUIT PROTECTOR; A. Stromberg, Chicago, Ill. App. filed Oct. 11, 1900. (See Current News and Notes.)

684,032. PROCESS OF MANUFACTURING OBJECTS FROM ASBESTOS; Adolf Wunsche, Charlottenburg, Germany. App. filed July 20, 1901. (See page 647.)

684,049. PLATE SEPARATING DEVICE FOR ELECTROLYTIC TANKS; E. G. Elliott and V. Kiihner, Perth Amboy, N. J. App. filed Dec. 24, 1900. (See page 647.)

684,083. SELF-REGULATING SYSTEM FOR ELECTRIC LIGHT AND POWER; M. Moskowitz, Brooklyn, N. Y. App. filed March 16, 1901. In a car-lighting system wherein the dynamo is driven from the axle, the field magnetism of the motor which drives the exciter of the generator is varied to correspond with variations in the armature current of the generator.

684,090. FUSE PLUG; C. D. Platt, Bridgeport, Conn. App. filed April 27, 1901. Details.

684,092. TERMINAL FOR ELECTRIC LAMP GLOWERS; H. N. Potter, Gottingen, Germany. App. filed Aug. 9, 1899. (See Current News and Notes.)

684,093. HEATER FOR ELECTRIC LAMP GLOWERS; H. N. Potter, Gottingen, Germany. App. filed Aug. 14, 1899. (See Current News and Notes.)

684,094. HEATER CUT-OUT FOR ELECTRIC LAMPS; H. N. Potter, Pittsburg, Pa. App. filed Feb. 14, 1901. (See Current News and Notes.)

684,111. TELEPHONE EXCHANGE SYSTEM; C. E. Scribner and J. L. McQuarrie, Chicago, Ill. App. filed Jan. 29, 1900. (See pages 645-646.)

684,114. SWITCH FOR ELECTRIC CONDUCTORS; T. B. Shaffer, Westmoor, Pa. App. filed July 23, 1901. Details.

684,122. TROLLEY; G. H. Spafford, Baltimore, Md. App. filed March 13, 1901. Details.

684,133. ELECTRIC TROLLEY CONSTRUCTION; E. G. Thomas, Cambridge, Mass. App. filed April 18, 1901. A flat trolley wire twisted to bring its width in a vertical direction to engage with the supporting clips.

684,136. TROLLEY WHEEL SUPPORT; C. Tochterman, Brooklyn, N. Y. App. filed March 8, 1901. The wheel has a certain lateral movement controlled by springs.

684,165. METHOD OF REGULATING ELECTRIC CIRCUITS; M. H. Baker, New York, N. Y. App. filed Sept. 5, 1899. (See Current News and Notes.)

684,166. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, New York, N. Y. App. filed March 12, 1900. Renewed March 9, 1901. (See Current News and Notes.)

684,167. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, New York, N. Y. App. filed March 21, 1900. Renewed March 9, 1901. (See Current News and Notes.)

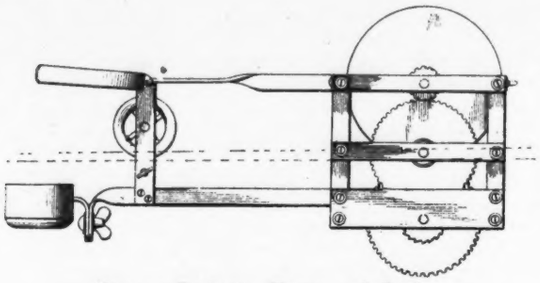
684,168. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, New York, N. Y. App. filed March 21, 1900. Renewed March 9, 1901. (See Current News and Notes.)

684,169. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, Newark, N. J. App. filed March 23, 1901. (See Current News and Notes.)

684,182. APPARATUS FOR BLEACHING ANIMAL OR VEGETABLE FIBER AND FABRIC MADE THEREFROM; F. J. Briggs, Everett, Mass. App. filed Jan. 17, 1901. (See page 647.)

684,188. BRUSH HOLDER; J. Bruke, Berlin, Germany. App. filed Nov. 2, 1899. Details.

684,194. SIGNAL FOR TELEPHONE TRUNK LINES; Henry M. Crane, of New York. App. filed Feb. 25, 1901. Provides means whereby the supervising operator at the A board may reset the ringing-signal to order the incoming trunk operator to ring again, thus avoiding taking up the time of the call wire.



683,515.—Conductor Cleaner and Carrier.

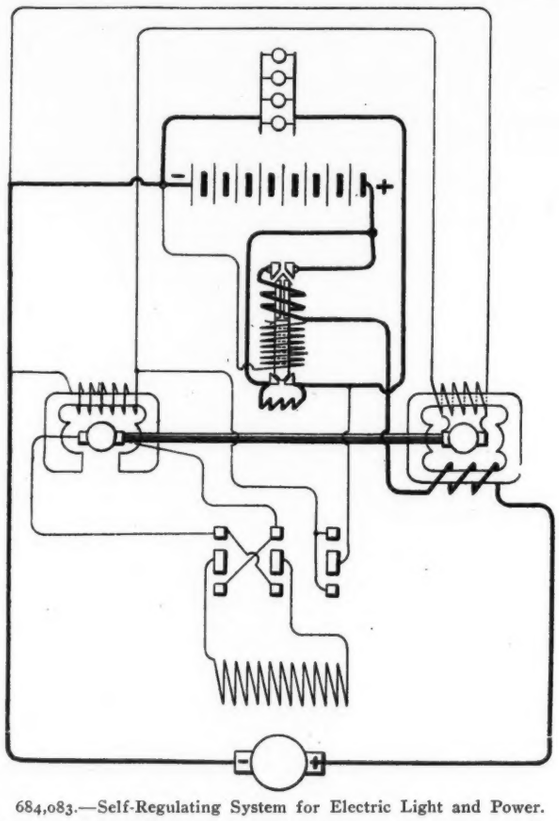
684,202. LOCK-OUT DEVICE FOR TELEPHONE SYSTEMS; Alfred Durbin, of McConnelsville, Ohio. App. filed Feb. 13, 1901. Provides means by which all the parties upon the line of a selector system except the central office and the subscriber or the two connected subscribers are prevented from using the line when the device is operated.

684,204. REVERSIBLE GALVANIC BATTERY; Thos. A. Edison, Llewellyn Park, N. J. App. filed Oct. 31, 1900. (See page 647.)

684,205. REVERSIBLE GALVANIC BATTERY; Thos. A. Edison, Llewellyn Park, N. J. App. filed June 20, 1901. (See page 647.)

684,222. TERMINAL FOR ELECTRIC LAMP GLOWERS; F. M. Goddard, Pittsburg, Pa. App. filed July 20, 1899. (See Current News and Notes.)

684,225. ELECTROMEDICAL DEVICE; G. Graybill, York, Pa. App. filed




684,083.—Self-Regulating System for Electric Light and Power.

March 6, 1901. The electrode of absorbent material is connected with a reservoir of medicine so that the current and the medicine can be simultaneously applied to the body.

684,229. GLOWER FOR INCANDESCENT LAMPS; M. W. Hanks, Pittsburg, Pa. App. filed March 24, 1899. (See Current News and Notes.)

684,230. GLOWER TERMINAL FOR ELECTRIC INCANDESCENT LAMPS; M. W. Hanks, Pittsburg, Pa. App. filed Sept. 27, 1899. (See Current News and Notes.)

684,255. ELECTRIC CABLE HANGER; G. W. Hughes, Philadelphia, Pa. App. filed Aug. 24, 1901. A loop of sheet metal having its ends brought together and bent back upon themselves to reinforce the part which receives the supporting hook.

684,269. ELECTRICAL APPARATUS FOR BODY WEAR; J. Kornitzer, Socorro, Territory of New Mexico. App. filed Aug. 12, 1901. Details.

684,274. AUTOMATIC LIGHTING SYSTEM FOR TELEPHONE STATIONS; Frederick Edward Lister, of Minneapolis. App. filed Jan. 14, 1901. Provides means for automatically switching on and off light in telephone booth by means of switchhook on which telephone directory is hung.

684,289. SIGNAL FOR TELEPHONE SWITCHING SYSTEMS; Frank R. McBerty, of Evanston, Ill.. App. filed Jan. 26, 1899. A system of signals for use in connection with call distributing systems to indicate to distributing operators whether a multipled trunk line is busy or not.

684,291. CATHODE PLATE; W. A. McCoy, Perth Amboy, N. J. App. filed Sept. 14, 1900. (See page 647.)

684,296. ELECTRIC FURNACE; W. Nernst, Gottingen, and L. Glaser, Coburg, Germany. App. filed July 6, 1900. (See page 647.)

684,303. ELECTRIC TELEPHONE SYSTEM; William E. Pembleton, of Wittenberg, Wis. App. filed Jan. 18, 1901. A device for eliminating resistance of the coils of magnets, bells and generators from the talking circuits of electric telephone systems.

684,315. MULTIPLE SWITCHBOARD SYSTEM; C. E. Scribner, of Chicago. App. filed Oct. 19, 1891. This patent, issued nearly ten years after the date of application, covers a system whereby the line drops, shunted by a low-resistance high impedance clearing out drop, fails to respond to a call signal sent after connection has been established; the necessity for contact points in the jacks being consequently done away with. The extensive adoption of relay switchboards makes this invention practically obsolete.

684,316. MULTIPLE SWITCHBOARD SYSTEM; C. E. Scribner, of Chicago. App. filed Feb. 11, 1892. Another invention in multiple switchboard systems rendered obsolete by the adoption of the relay board.

684,317. TELEPHONE EXCHANGE APPARATUS; C. E. Scribner, Chicago. Application filed March 24, 1890. Renewed May 9, 1893.

684,326. VACUUM ELECTRODE FOR THERAPEUTIC PURPOSES; R. H. Wappler, New York, N. Y. App. filed March 5, 1901. A glass electrode, hollow and containing a vacuum chamber, is adapted to be adjusted to a metallic handle.

684,332. CONTROLLER HANDLE; E. A. Wildt, Scranton, Pa. App. filed Feb. 27, 1901. The handle is locked at each step, and must be unlocked before it can be moved onward.

684,338. SYSTEM OF ELECTRICAL DISTRIBUTION; H. J. Gille, St. Paul, Minn. App. filed Nov. 15, 1900. A number of sources of electrical energy, a series of bus bars of uniform potential each connected to one pole of one source of energy, a neutral bus-bar connected with the remaining pole of each source of energy, one or more three-wire translation circuits, the neutral conductor of which is connected to the neutral bus bar and means for connecting the external conductors of said translation circuit or circuits respectively with pairs of said bus bars.

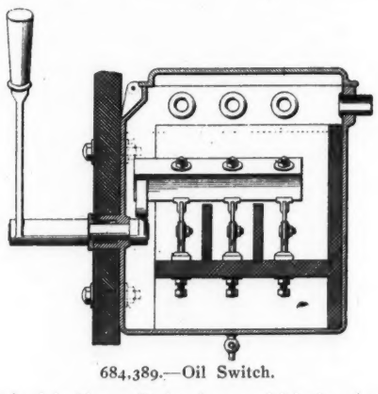
684,340. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, New York, N. Y. App. filed March 21, 1900. (See Current News and Notes.)

684,341. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, New York, N. Y. App. filed May 11, 1900. (See Current News and Notes.)

684,342. REGULATING DEVICE FOR ARC LAMP CIRCUITS; M. H. Baker, New York, N. Y. App. filed March 12, 1900. Renewed March 9, 1901. (See Current News and Notes.)

684,351. ELECTROTHERAPEUTIC INSTRUMENT; A. W. Pourtney and J. S. Mead, Buffalo, N. Y. App. filed Dec. 19, 1900. A device for passing current through the male genital organ.

684,366. TELEPHONE EXCHANGE APPARATUS AND CIRCUIT; Georg Grabe and Lipa Polinkowsky, of Berlin. Application filed May 25, 1901.



684,389.—Oil Switch.

Covers method of locking call signal on multiple board with electro magnetic signals.

684,373. TROLLEY GUARD; R. Inglis and E. Wilks, Jersey City, N. J. App. filed Aug. 3, 1900. Details.

684,376. STORAGE BATTERY; Levi W. Lombard, of Boston, Mass. App. filed Nov. 15, 1900. A series of separately formed strips of trough shape are united together in the form of a plate, the strips having a series of fine longitudinal corrugations. The spaces between the troughs are occupied by active material.

684,378. ELECTRIC LAMP; H. N. Potter, Pittsburg, Pa. App. filed Feb. 14, 1901. (See Current News and Notes.)

684,389. OIL SWITCH; J. H. Vail, Philadelphia, Pa. App. filed Dec. 28, 1900. Details.

684,391. POROUS CUP; S. De Ayola, New York, N. Y. App. filed May 1, 1901. (See page 647.)

# Awards at the Pan-American Exposition.

WE present below a list of recompenses adjudged to exhibitors at the Pan-American Exposition, Buffalo, as determined by the various Juries of Award, and embracing those of interest to our readers in the various fields of electricity, transportation, mechanics, liberal arts, etc.

It may be stated that the exhibits at the Exposition were grouped in 17 divisions, and that in all 7000 exhibits were examined and reported upon, while 150 persons well-known in the arts and sciences served upon the juries under the general direction of a superintendent of awards. The work of these juries was supplemented by that of a Superior Jury, which included about 40 persons, who reviewed the work of the separate juries, determining finally and without appeal the order of merit of the awards .

It should be noted in passing that a considerable number of exhibitors, some of them amongst the largest and best-known corporations and individuals in the country, did not compete for awards by submitting their exhibits to the jury, a fact which should be borne in mind in view of the absence of such names from the list. Four classes of awards were offered the exhibitors, viz., diplomas of gold medals, diplomas of silver medals, diplomas of bronze medals, diplomas of honorable mention.

Several of the Government departments come in for special mention in the report of a special jury. Particular attention is called in it, for example, to the Patent Office, and amongst the machines included in the exhibit there are mentioned the telautograph and the electrograph. In the exhibit of the War Department special attention is called to the display by the Signal Corps, and it is noted that the apparatus for wireless telegraphy added much to the attractiveness of the space by its daily demonstrations.

Altogether, the work done by Dr. Henry S. Pritchett, superintendent of awards, appears to have been put through with promptness and carefulness and absolute fairness. This early publication of the list of awards is a subject for high commendation.

## DIVISION VIII.—MINES AND METALLURGY.

### EXHIBITORS HORS CONCOURS.

Massachusetts Institute of Technology, Boston, president of Institute chairman of superior jury.

### GOLD MEDALS.

American Steel & Wire Company, Chicago, Ill., steel and finished steel products.

Acheson, Edward G., Niagara Falls, artificial graphite and carborundum.

### SILVER MEDALS.

Baker & Co., Newark, N. J., platinum metals and products.

Johns Manufacturing Company, H. W., New York City, exhibit showing evolution of asbestos.

Michigan College of Mines, Houghton, Mich., collective exhibit of ores, minerals and photographs illustrative of the mineral resources of Michigan.

### BRONZE MEDALS.

McKenna Brothers, Pittsburg, Pa., laboratory ore grinder.

Sills-Eddy Mica Company, New York City, samples of mica mined in United States.

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## DIVISION IX.—MACHINERY.

### JURORS.

Ira N. Hollis, chairman; Luis de Arozarena, William L. Aughinbaugh, R. C. Carpenter, Mortimer E. Cooley, E. G. Fischer, Charles T. Higginbotham, Emique Lanz, Cecil H. Peabody, Perry Benjamin Pierce, H. W. Spangler, Frederick A. Tennant.

### GOLD MEDALS.

#### UNITED STATES.

Alberger & Son, J. L., Buffalo, 125-hp Buffalo tandem gas engine.

American Steam Gauge & Valve Manufacturing Company, Boston, steam gauges and engine fittings.

American Tool Works Company, The, Cincinnati, Ohio, radial drill.

American Tool Works Company, The, Cincinnati, Ohio, lathe.

American Tool & Machine Company, Boston, Mass., centrifugal machine.

Acme Machine Screw Company, Hartford, Conn., multiple spindle automatic screw machine.

American Steel & Wire Company, Chicago, diamond dies for drawing wire.

Buffalo Forge Company, Buffalo, steam engines.

Buffalo Forge Company, Buffalo, blowers and fans.

Bullard Machine Tool Company, The, Bridgeport, Conn., turret and engine lathe.

Bullard Machine Tool Company, The, Bridgeport, Conn., boring mill.

Bement, Miles & Co., Philadelphia, steam hammer.

Becker-Brainard Milling Machine Company, Hyde Park, Mass., vertical milling machine.

Carborundum Company, The, Niagara Falls, N. Y., carborundum.

Cincinnati Machine Tool Company, The, Cincinnati, Ohio, upright drill.

Cincinnati Milling Machine Company, Cincinnati, Ohio, universal milling machine.

Cleveland Twist Drill Company, Cleveland, Ohio, twist drills, reamers and cutters.

Cleveland Machine Screw Company, Cleveland, Ohio, automatic turret lathe and chucking machine.

Cleveland Machine Screw Company, Cleveland, Ohio, worm milling machine.

Fayerweather & Ladew, New York City, Hoyt Brand leather belting.

Ferracute Machine Company, Bridgeton, N. J., stamping machinery.

Gray Company, The G. A., Cincinnati, Ohio, planers (metal).

Heald & Son, L. S., Barre, Mass., American twist drill grinders.

Jenkins Brothers, New York City, steam and water valves.

Jenkins Brothers, New York City, Jenkins 96-sheet packing.

Lunkenheimer Company, The, Cincinnati, Ohio, valves, lubricators and engine fittings.

Long & Allstatter Company, Hamilton, Ohio, power punching and shearing machine.

Lodge & Shipley Machine Tool Company, The, Cincinnati, Ohio, engine lathe.

Marinette Iron Works Manufacturing Company, Marinette, Wis., Walrath gas engine, 125 horse-power.

Mietz, August, New York City, kerosene engine.

Morse Twist Drill & Machine Company, New Bedford, Mass., machine tools.

Niles Tool Works Company, The, Hamilton, Ohio, boring and turning machines.

National Meter Company, New York City, water meters.

National Meter Company, New York City, gas engines.

Otto Gas Engine Works, Philadelphia, Pa., gas engines.

Pond Machine Tool Company, The, Plainfield, N. J., planer.

Pratt & Whitney Company, Hartford, Conn., drills, reamers, cutters and measuring tools.

Pratt & Whitney Company, Hartford, Conn., profiling machine.

Pratt & Whitney Company, Hartford, Conn., double-head milling machine.

Robins Conveying Belt Company, New York City, belt conveyor.

Rodney Hunt Machine Company, Orange, Mass., waterwheels and pumps.

Reeves Pulley Company, Columbus, Ind., variable speed transmission.

Roebling's Sons Company, John A., Trenton, N. J., power transmission (wire rope).

Roebling's Sons Company, John A., Trenton, N. J., wire.

Straight Line Engine Company, The, Syracuse, N. Y., steam engine.

Schieren & Co., Charles A., New York City, "Bull's Head" Electric and "Royal Extra" brands leather belting.

Struthers, Wells & Co., Warren, Pa., 300-hp gas engine.

Starrett Company, The L. S., Athol, Mass, mechanical tools.

White Company, The O. C., Worcester, Mass., appliances for shop lighting.

Wilmarth & Morman Company, Grand Rapids, Mich., drill-grinding machine.

Warner & Swasey Company, The, Cleveland, Ohio, hollow hexagon turret lathe.

Washburn Shops, The, Worcester, Mass., drill grinders.

Worthington, Henry R., Brooklyn, N. Y., jet condenser.

Walworth Manufacturing Company, Boston, Mass., valves, fittings and tools.

## SILVER MEDALS.

### UNITED STATES.

American Steel & Wire Company, Chicago and New York City, cold-drawn shafting.

American Blower Company, Detroit, Mich., fans and blowers.

Ames Iron Works, Oswego, N. Y., automatic steam engines.

American Roller Bearing Company, Boston, Mass., roller bearings.

Ball Engine Company, Erie, Pa., steam engine.

Buffalo Forge Company, Buffalo, punches, shears and forges, induced draught, blacksmiths' drills.

Bradford Machine Tool Company, Cincinnati, Ohio, engine lathe with turret attachment.

Bement, Miles & Co., Philadelphia, vertical milling machines.

Burt Manufacturing Company, Akron, Ohio, oil filters.

Bliss Company, E. W., Brooklyn, N. Y., sheet-metal stamping and drawing machines.

Bickford Drill & Tool Company, Cincinnati, Ohio, radial and multiple drill.

Cameron Steam Pump Works, A. S., New York City, steam and air pumps.

Chicago Pneumatic Tool Company, Chicago, pneumatic tools and appliances.

Cincinnati Planer Company, Cincinnati, Ohio, spur-gear planers.

Foos Manufacturing Company, The, Springfield, Ohio, gas and gasoline engines.

Foos Manufacturing Company, The, Springfield, Ohio, attrition grinding mills and crushers.

Green Fuel Economizer Company, The, Matteawan, N. Y., fuel economizer.

Gisholt Machine Company, Madison, Wis., tool grinders.

Gisholt Machine Company, Madison, Wis., turret lathes.

Hazard Manufacturing Company, Wilkesbarre, Pa., wire rope.

Heald & Son, L. S., Barre, Mass., American lathe center grinder.

Heald & Son, L. S., Barre, Mass., sash trimmers.

Jenkins Brothers, New York City, Jenkins pump, valves and disk.

Lane & Bodley Company, The, Cincinnati, Ohio, Corliss steam engine.

Norton Emery Wheel Company, Worcester, Mass., "Bath" machine indicators.

Niles Tool Works Company, The, Hamilton, Ohio, radial drills.

Prentiss Tool & Supply Company, New York City, general arrangement of exhibit of machine tools.

Pratt & Whitney Company, Hartford, Conn., automatic turret lathes.

Pratt & Whitney Company, Hartford, Conn., compound boring machine.

Pratt & Whitney Company, Hartford, Conn., automatic toolmakers' lathe.

Standard Tool Company, The, Cleveland, Ohio, twist drills, reamers, milling cutters and taps.

Williams & Co., J. H., Brooklyn, N. Y., drop-forged wrenches and chain pipe wrenches.

Wheeler Condenser & Engineering Company, New York City, Admiralty Surface Condenser, with combined air and circulating pump.

Weber Gas & Gasoline Engine Company, Kansas City, Mo., gas and hoisting engines.

Warner & Swasey Company, Cleveland, Ohio, vertical boring and chucking machines.

## BRONZE MEDALS.

### UNITED STATES.

Abendroth & Root Manufacturing Company, New York City, improved Root water tube safety boiler.

American Blower Company, Detroit, Mich., blower engine.

American Tool Works Company, Cincinnati, Ohio, planers.

American Tool Works Company, Cincinnati, Ohio, shaper.

Becker-Brainard Milling Machine Company, Hyde Park, Mass., horizontal drill.

Barnes Company, B. F., Rockford, Ill., wet tool grinder.

Chicago Belting Company, Chicago, "Reliance" brand leather belting.

Cleveland Machine Screw Company, Cleveland, Ohio, brass work lathes.

Harrison Safety Boiler Works, Philadelphia, Pa., Cochrane steam and oil separator.

Harrison Safety Boiler Works, Philadelphia, Pa., drainage system for vacuum oil separator.

Keasbey, Robert A., Buffalo, magnesia covering.

Knowles Steam Pump Works, New York City, triplex electric pump.

Murray Iron Works, Burlington, Iowa, compound Corliss engine.

Monarch Manufacturing Company, Waterbury, Conn., safety engine stop valves.

Monarch Fire Appliance Company, New York City, "Kilfyre" dry powder fire extinguisher.

Neemes Brothers, Troy, N. Y., shaking grate.

Norton Emery Wheel Company, Worcester, Mass., bench and floor-grinding machinery.

Norton Emery Wheel Company, Worcester, Mass., Walker universal tool and cutter grinder.

National Pipe Bending Company, The, New Haven, Conn., coils of iron, brass and copper pipe.

Otto Gas Engine Works, The, Philadelphia, Otto railroad water crane.

Pratt & Whitney Company, Hartford, Conn., cock and key machine.

Pratt & Whitney Company, Hartford, Conn., centering machine.

Pond Machine Tool Company, Plainfield, N. J., lathe.

Replogle Governor Works, The, Akron, Ohio, waterwheel governors.

Skinner Engine Company, Erie, Pa., steam engine.

Snow Steam Pump Works, The, Buffalo, steam pumps.

Underfeed Stoker Company of America, Chicago, Jones underfeed stoker.

Wilmarth & Morman Company, Grand Rapids, Mich., friction countershaft.

Watertown Engine Company, Watertown, N. Y., Corliss engine.

## HONORABLE MENTION.

### UNITED STATES.

Abendroth & Root Manufacturing Company, New York City, Root's spiral riveted pipe.

American District Steam Company, Lockport, N. Y., underground system of steam heating from central station.

Bement, Miles & Co., Philadelphia, Pa., key-seat cutter.

Becker-Brainard Milling Machine Company, Hyde Park, Mass., grinding machine.

Cling-Surface Manufacturing Company, Buffalo, Cling-Surface belt dressing.

Cincinnati Milling Machine Company, The, Cincinnati, Ohio, universal cutter and reamer-grinder.

Harrison Safety Boiler Works, Philadelphia, Cochrane feed water heater and purifier.

Kennedy Valve Manufacturing Company, The, New York City, iron and brass valves.

Warner & Swasey Company, Cleveland, Ohio, special milling machines.

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## DIVISION X.—ELECTRICITY.

### JURORS.

Carl Hering, chairman; Arthur V. Abbott, Henry S. Carhart, William S. Franklin, Winder Elwell Goldsborough, Dugald C. Jackson, A. E. Kennelly, William L. Puffer.

## GOLD MEDALS.

### UNITED STATES.

American Steel & Wire Company, Chicago, New York City, electric wires and cables.

Belding Brothers, New York City, electrical silk.

Delany, Patrick B., South Orange, N. J., apparatus for rapid telegraphy.

General Electric Company, Schenectady, N. Y., machinery and apparatus for generating and using electricity.

General Electric Company, Schenectady, N. Y., electric lighting apparatus.

General Electric Company, Schenectady, N. Y., electrical measuring instruments.

Holophane Glass Company, New York City, Holophane glass globe.

Johnson, Eldridge R., Camden, N. J., mechanical apparatus for reproducing sound.

Kellogg Switchboard & Supply Company, Chicago, telephone systems and apparatus.

National Carbon Company, Cleveland, Ohio, carbon products.

Niagara Falls Power Company, Niagara Falls, N. Y., electric transmission plant, as illustrated by model.

Pittsburg Reduction Company, Niagara Falls, N. Y., electrical conductors of aluminum.

Roebling's Sons Company, John A., Trenton, N. J., wires and cables.

Safety Ins. Wire & Cable Company, The, New York City, electric wires and cables.

Standard Underground Cable Company, Pittsburg, Pa., electric wires and cables.

Stanley Electric Manufacturing Company, Pittsfield, Mass., high-tension alternating-current apparatus.

Stanley Instrument Company, Great Barrington, Mass., electric wattmeters.

Stromberg-Carlson Telephone Manufacturing Company, Chicago, telephone exhibit and service.

## SILVER MEDALS.

### UNITED STATES.

American Clock Company, The, Chicago, electric clocks.

American Vitrified Conduit Company, New York City, vitrified clay conduits.

Bernard Company, The E. G., Troy, N. Y., motor-generator sets and accessories.

Bullock Electric Manufacturing Company, Cincinnati, Ohio, dynamos and motors.

Camp Company, H. B., Akron, Ohio, vitrified conduits.

Crocker-Wheeler Company, Ampere, N. J., dynamos and motors.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., motor starters and controllers.

D. & W. Fuse Company, Providence, R. I., fuses and fuse fittings.

Edison Manufacturing Company, Orange, N. J., mechanical apparatus for recording and reproducing sound.

Edison Manufacturing Company, Orange, N. J., Edison-Lalande battery.

Electric Storage Battery Company, Philadelphia, methods and appliances for the distribution of electric energy.

Electric Storage Battery Company, Philadelphia, storage batteries.

Eureka Tempered Copper Works, North East, Pa., tempered copper and cast copper.

Gould Storage Battery Company, New York City, storage battery.

Hazard Manufacturing Company, Wilkesbarre, Pa., insulated wire and cables.

Hydra Double Battery Company, New York City, dry battery.

Illuminating Appliance Company, New York City, prismatic reflectors.

McRoy Clay Works, Brazil, Ind., vitrified conduits.

National Gramophone Corporation, New York City, mechanical apparatus for reproducing sound.

Northern Electric Manufacturing Company, Madison, Wis., direct-current dynamos and motors.

Queen & Co., Philadelphia, self-regulating X-Ray tube.

Stanley Electric Manufacturing Company, Pittsfield, Mass., measuring instruments.

Wagner & Co., R. V., Chicago, mica plate Holtz machine.

Wagner Electric Manufacturing Company, St. Louis, single-phase motors and transformers.

## BRONZE MEDALS.

### UNITED STATES.

American Electric Telephone Company, Chicago, telephone apparatus.

American Engine Company, Bound Brook, N. J., direct-connected dynamos.

Bettini, Lieutenant G., New York City, mechanical apparatus for recording and reproducing sounud.

Bossert Electric Const. Company, Utica, N. Y., switches.

Brown, Harold P., New York City, plastic amalgam joints.

Clark Auto. Tele. & Switchboard Company, Providence, R. I., automatic telephone switchboard.

Dicke Tool Company, The, Downers Grove, Ill., electric wiremen's tools.

Inc. Elec. Lt. Man. Company, Boston, Mass., lamp manipulator and attachments.

Jandus Electric Company, The, Cleveland, Ohio, enclosed arc lamp.

Jantz & Leist Electric Company, Cincinnati, Ohio, electroplating dynamos and driving motor.

Keystone Electric Company, Erie, Pa., direct-current generator.

Lincoln, P. M., Niagara Falls, N. Y., phase indicator.

Mason Monogram Company, New York City, illuminated sign.

Morris Electric Company, New York City, Morris rail bond and hydraulic splicing machine.

National Carbon Company, Cleveland, Ohio, primary cells.

Onondaga Dynamó Company, Syracuse, N. Y., direct-connected dynamo and electric motors.

Peru Electric Manufacturing Company, Peru, Ind., porcelain devices for electric purposes.

Porter Battery Company, Chicago, storage batteries.

Pyle National Electric Headlight Company, Chicago, electric headlight.

Roche, William, New York City, dry cells.

Standard Paint Company, New York City, P. & B. tape, insulating compound and armature and field-coil varnish.

Submerged Electric Motor Company, Menominee, Wis., submerged electric motor and propeller.

Toerring Company, C. J., Philadelphia, arc lamps.

Waite & Bartlett Manufacturing Company, New York City, X-Ray apparatus.

Wilhelm Telephone Manufacturing Company, Buffalo, telephone apparatus.

### MEXICO.

Reyes, L., San Luis Potosi, State of San Luis Potosi, telephone.

## HONORABLE MENTION.

### UNITED STATES.

American Watchman's Time Detector Company, New York City, watchman's time detector.

Arnold Electric Power Station Company, Chicago, power station system and clutches, illustrated by models.

Bogue, Charles J., New York City, electric searchlight.

Buckeye Electric Company, The, Cleveland, Ohio, incandescent lamps.

Chicago Fuse Wire & Manufacturing Company, Chicago, fuse wires and links.

D'Olier Engineering Company, Philadelphia, dynamo switchboard.

Edison Manufacturing Company, Orange, N. J., nine-inch battery fan motor.

Hall, Alvah W., New York City, automatic advertiser,

Jandus Electric Company, The, Cleveland, Ohio, electric fan motor.

Lea Electric Manufacturing Company, Elwood, Ind., enclosed arc lamps.

Meyrowitz, E. B., New York City, eye magnet.

Parsell & Weed, New York City, model dynamo.

Robbins & Myers Company, The, Springfield, Ohio, dynamos and motors.

Rowell, C. B., Buffalo, static electric machines.

Sage & Bro., F. B., New York City, direct-reading ohmmeter.

Sprague Electric Company, New York City, electric motors.

Stow Manufacturing Company, Binghamton, N. Y., multi-speed motor and flexible shaft.

White Company, The, O. C., Worcester, Mass., adjustable lamp arm.

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## DIVISION XI.—TRANSPORTATION.

### JURORS.

H. G. Prout, chairman; Arthur V. Abbott, William L. Aughinbaugh, Albert C. Bostwick, R. C. Carpenter, J. M. Carson, Jr., Frederic A. Delano, David Porter Heap, C. H. McLellan, Henry M. Paul, Cecil H. Peabody, George D. Shepardson, Ambrose Swasey, J. Elfreth Watkins.

GOLD MEDALS.

UNITED STATES.

Consolidated Railway, Electric Lighting & Equipment Company, New York City, car light by electric power from the axle.

De Dion-Bouton Motorette Company, Brooklyn, N. Y., motorettes, bicycles and quadricycles.

Electric Vehicle Company, New York City, electric vehicles (variety and completeness).

Electric Vehicle Company, New York City, electric automobiles.

General Electric Company, Schenectady, N. Y., electric traction apparatus and system.

Lidgerwood Manufacturing Company, New York City, electric ship's winch.

Roebling's Sons Company, John A., Trenton, N. J., general exhibit in transportation.

SILVER MEDALS.

UNITED STATES.

Gold Car Heating Company, New York City, car-heating apparatus.

McGuire Manufacturing Company, Chicago, trucks and appliances for electric cars.

BRONZE MEDALS.

UNITED STATES.

Continuous Rail Joint Company of America, Newark, N. J., rail joints for steam and street railroads.

Electric Vehicle Company, New York City, gasoline automobile.

HONORABLE MENTION.

UNITED STATES.

Palmer Brothers, Mianus, Conn., gasoline engines and launches.

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DIVISION XII.—ORDNANCE AND MUNITIONS OF WAR.

JURORS.

George Eugene Belknap, chairman; Philip R. Alger, Peter C. Harris, Victor Hernandez, Richmond Pearson Hobson, C. F. Shoemaker, Thom Williamson, John P. Wisser.

GOLD MEDALS.

UNITED STATES.

American Bridge Company, New York City, steel structural material and steel buildings (ordnance).

Ritchie & Sons, E. S., Brookline, Mass., ships' compasses.

BRONZE MEDALS.

UNITED STATES.

Ferracute Machine Company, Bridgeton, N. J., brass cartridge cases.

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DIVISION XIII.—MANUFACTURES.

JURORS.

Edmund A. Engler, chairman; Wm. L. Aughinbaugh, Marcus Benjamin, Morris Benson, A. H. Bottum, J. M. Carson, Jr., John L. Choyer, F. W. Clarke, George Coit, Stanley T. Cozzens, John G. Eppendorff, Alberto Falcon, M. L. Floyd, David Porter Heap, W. H. Holmes, John R. Kendrick, F. P. Machado, Edward S. More, Henry M. Paul, Frank H. Peabody, G. G. Pond, W. de C. Ravenel, John K. Rees, Edward Rovinson, Jose A. Saenz, Carlos Sellerier, George D. Shepardson, John Strootman, Ambrose Swasey, Evaldo Tirade, Juan P. Tomas, Charles H. Turner, Harry Walbridge, Mrs. Lester Wheeler, Miss Eugenie Hauenstein.

GOLD MEDALS.

UNITED STATES.

Pittsburg Reduction Company, The, Pittsburg, aluminum.

Roessler & Hasslacher Chemical Company, The, New York City, acetone and chloroform.

Standard Paint Company, The, New York City, ruberoid roofing and flooring.

Williams & Co., J. H., Brooklyn, drop forgings and special designs.

SILVER MEDALS.

UNITED STATES.

Cassidy & Son Manufacturing Company, New York City, electric fixtures.

Frink, I. P., New York City, reflectors.

Grant Tool Company, Franklin, Pa., brass and steel balls.

Grasselli Chemical Company, The, Cleveland, Ohio, chemicals.

Standard Paint Company, The, New York City, P. & B. rubberine paints and varnish.

United Indurated Fiber Company, Lockport, N. Y., indurated fiberware.

Union Carbide Company, Niagara Falls, N. Y., the Horry carbide furnace and products.

White Company, The O. C., Worcester, Mass., adiustable electroliers.

BRONZE MEDALS.

UNITED STATES.

Blickensderfer Manufacturing Company, The, Stamford, Conn., electrical typewriting machine.

Mygatt, O. A., New York City, new patent prism globes.

Norton Emery Wheel Company, Worcester, Mass., India oil stones.

Standard Paint Company, The, New York City, P. & B. waterproof case lining and wrapping paper.

Vosburgh Manufacturing Company, Limited, W. C., Brooklyn, electric and gas fixtures.

HONORABLE MENTION.

UNITED STATES.

Jenkins Brothers, New York City, electro-magnetic lamp holders.

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DIVISION XIV.—GRAPHIC ARTS.

JURORS.

Theodore Low De Vinne, chairman; Marcus Benjamin, Julio Perez Canto, Stephen J. Kubel, D. B. Wainwright.

SILVER MEDALS.

UNITED STATES.

Jantz & Leist Electric Company, Cincinnati, Ohio, electrotyper's motor-generator.

HONORABLE MENTION.

UNITED STATES.

Charles J. Bogue, New York City, photo-engraving lamp.

Cutler-Hammer Manufacturing Company, The, New York City, printing press electric controller.

Edison, Thomas A., Orange, N. J., Edison numbering machine.

New England Motor Company, Lowell, Mass., 5-hp compound motor, type M. E.

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DIVISION XV.—LIBERAL ARTS.

EXHIBITORS HORS CONCOURS.

Massachusetts Institute of Technology, Boston, Mass., president of Institute chairman of superior jury.

GOLD MEDALS.

Keuffel & Esser Company, New York City, surveying instruments and drawing materials.

Pratt Institute, Brooklyn, New York, Students' work, showing educational methods and results.

Rensselaer Polytechnic Institute, Troy, N. Y., students' work, showing educational methods and results.

Roebling's Sons Company, John A., Trenton, N. J., bridge engineering.

McGraw Publishing Company, New York City, ELECTRICAL WORLD AND ENGINEER, etc., technical books, etc.

Worcester Polytechnic Institute, Worcester, Mass., students' work, showing educational methods and results.

SILVER MEDALS.

The Western Electrician, Chicago, Ill., publication, *The Western Electrician.*

BRONZE MEDALS.

International Correspondence Schools, Scranton, Pa., photographs, courses of study, pupils' work.

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INSTALLATION.—DIVISION X.

GOLD MEDALS.

Edison Manufacturing Company.

SILVER MEDALS.

General Electric Company.

BRONZE MEDALS.

The Safety Insulated Wire & Cable Company.

HONORABLE MENTION.

American Electric Telephone Company.

Buckeye Electric Company.

Kellogg Switchboard & Supply Company.